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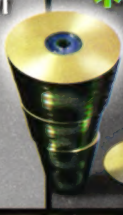
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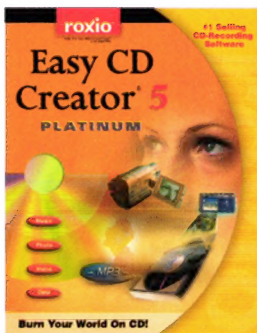
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WINDOWS VS. LINUX VS. APPLE



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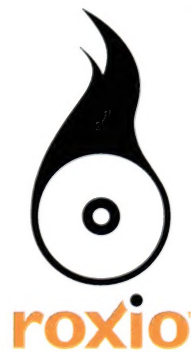
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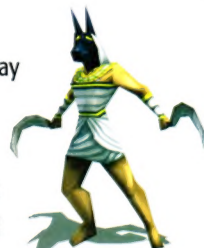
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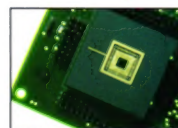
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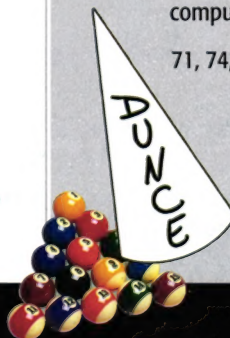


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GREETINGS FROM SAMITLAND

I guess it's time for a good and sound Happy New Year's! Welcome back. So 2003 is finally upon us. It took a damn long time to get here. 2-0-0-3. I still remember being a wee lad of 7 years of age in 1976 as my family prepared to make a move from Jamaica (Bob Marley, mon) to Nigeria ("please give us your bank account so we can ship you monies [you sucker]"). It was late in the year, my parents wouldn't let me see "Jaws," and 1977 (and a little movie known as "Star Wars") was just around the corner. Around this time a small network known as the ARPANET (the birth of the Internet) was being formed, Steve Wozniak was selecting a processor for his first Apple, and the Commodore PET was on the near horizon. I played with my first electronic game: Pong. Little did I think of the computing milestones that lay ahead.

1980. I was heading into sixth grade at Hillcrest School (in Jos, Nigeria). High school graduation wasn't even on the radar, and I'd just learned to ride a skateboard. Girls were kind of yucky, but much less than they had been in fifth grade. A year prior, the TRS-80 Model II had just been released back in the States. Sure, I'd heard of computers but had never really seen one—Pong was still the closest thing to a computer I'd ever been around. I didn't yet know that Microsoft was getting ready to write an OS for IBM, that the Commodore Vic 20 and Apple Lisa were just around the corner, and Windows 1.0 was going to be announced in three years. However, I was on the verge of my first (mobile) computer experience: the portly Osborne 1 and CP/M.

1990. My junior year at Creighton University (in Omaha, Nebr.). Computers and I were now on friendly terms; especially when it came time to play games. Yeah, and I was bit of a slacker in undergrad, but the profs were loathe to cut me slack (good for them—it made me work harder). Outside of an Apple, this was my first experience with a Windows-wannabe-GUI: Windows 3.0. We were running it in the labs, and it was a far cry from Windows 2. Also, the PCI bus was about to be proposed and we were still a good five years away from "Chicago" (or Windows 95).

Looking back over the years always makes for a nostalgic mind-trip; sometimes it's good and sometimes it's not so good. There's little point living in the past, and looking forward always fills me with hope. I don't exactly remember when the years started speeding by at this breakneck pace, from months feeling like years to years feeling like months, but I always look forward to a new year because there's always so much to discover. That's the journey we want to take you on in each issue of *CPU*; along the way we want to entertain and inform you about how to make the best out of what's here and to look ahead to what's coming. This month, Sharky (page 35) takes a look back at 2002 and Anand (page 34) looks forward to Intel's 2003 roadmap. Our Spotlight (page 50) puts OSes to the test: Windows XP Pro vs. SuSE Linux 8.1 Pro vs. Apple Jaguar. Enjoy.

In the meantime, I'll look forward to seeing you next month. Be well and have a safe and happy New Year's.

Samit G. Choudhuri, Publication Editor, *CPU*



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ViewSonic Makes Mira Real

Without waiting to see if tablet PCs fly or fail in the market, Microsoft's next-gen LCD monitor-cum-tablet platform, aka Mira, is poised for release. ViewSonic will be first to market with two "Smart Display" designs: the *airpanel*



V110 (\$999) and V150 (\$1,299). When mounted in the optional base station, the panel operates as a PC display. Unsnap it, and you've got a 10-inch or 15-inch, 802.11b-driven tablet based on Windows CE. XGA resolution means far less scrolling than with earlier tablets, and the Li-Ion battery delivers roughly five hours of runtime. Only 1.8 inches deep, the V150 is still a hefty 5.5 pounds, so plan on using it more for surfing and checking email on your lap than attempting one-handed computing sessions.

"Displays are becoming more intelligent, mobile, and versatile,"

says Tom Offutt, general manager, Mobile and Wireless Division, ViewSonic. "Our *airpanel* V110 and V150 Smart Displays will unchain users from their home desktop, enabling them to have always-on, anytime connectivity to all of their Windows XP applications, data, and services from any room in the home."

ViewSonic readily admits that the first wave of *airpanels* is meant for early adopters, but as weights and prices fall over time, expect smart displays to heavily impact how computers are used in the home. ▲

Microsoft's Mira platform, now called Smart Display, has arrived, and ViewSonic's *airpanel* V150 is one of the first models. Dock it, and the V150 is a monitor. Unplug it and you have a wireless Tablet PC.

Nokia Gears Up For Mobile Gaming

Move over, Game Boy. Cell phone titan Nokia is getting ready to create a new handset category it calls a "game deck." Whereas today's cell phones are voice devices that feature SMS, PIM, and other data services plus a stray game or two, game decks will focus primarily on gaming then add voice and data as secondary features.

"Right now, I can play Snake or whatever on my phone, but I have to use one hand," says Nokia spokesperson Denise Crew. "What we've done here is create a two-handed device optimized for gaming but that still provides all of the advanced digital services people need."

Game titles will be distributed on memory cards, and Bluetooth networking will enable local multiplayer gaming. Nokia has noted that operators will benefit from increased data airtime, but details on this, as well as device specs and pricing, are being held until February 2003. ▲



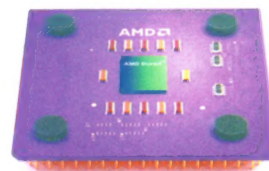
Nokia's forthcoming N-Gage mobile game deck aims to spawn a new breed of handset by being a single- and multiplayer gaming device first, then a smart phone second.

Duron's Demise?

A moment of silence, please, for the passing of AMD's low-end processor line, Duron. The word on the Web (not to mention In-Stat's Microprocessor Report) is that AMD is letting its dealers and distributors know that the fourth quarter of 2002 will be desktop Duron's last. The D1300, which is already struggling against a two-week order backlog, will be Duron's highest peak before giving way to the Athlon.

The official word is a bit different: "AMD will continue to support Duron through 2003 and as long as the market asks for it," says AMD spokesperson Damon Muzny.

AMD fab plants 25 and 30, the two that have traditionally produced Duron chips, are currently not manufacturing Duron, which essentially means that production has stopped. AMD itself hasn't used the word "discontinued" yet, but given that the company is moving to selling processors based on performance, a frequency-rated product makes less and less sense. Athlon will become AMD's sole product family for every consumer segment, starting with base models for "value" PCs and ultimately extending up into Hammer-based chips sometime next year. ▲



Hasta la vista, Duron. Although AMD will keep the chip on life support while stocks last, the low-end processor is now mostly dead.



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Entertainment Box? PC? You Decide



Smaller than a set-top box, the new FIC RaptureWare Falcon CR51 (est. \$179; www.fic.com.tw) opens up a new category in small form factor computing. Out of the box, the Falcon is a diskless entertainment unit with on-screen modules for DVD, CD, and MP3 playback. There is no hard drive and only a minuscule OS built into ROM, enabling a four-second boot time. The mini-ITX motherboard features VIA's Apollo PLE

133 chipset and a fanless C3 processor. Video, audio, and Ethernet are all integrated, and there are two PCI slots and two drive bays. This means that by popping in a hard drive and loading an OS, the Falcon suddenly becomes a bona fide value PC. The RaptureWare approach seems a perfect fit for home users who want a living room entertainment box (for less cost than many DVD players, by the way) and the option to upgrade into a

more powerful network computer if and when needed.

"FIC is also expanding the RaptureMedia option to our high-performance motherboards and laptops," notes FIC product manager Alex Mei. "Imagine being able to watch your DVDs on your laptop on the plane and actually finish the movie because RaptureMedia is able to function without completely booting up your system, saving both power and computing." ▲

FIC's Falcon is an inexpensive entertainment appliance out of the box, but add a hard drive and you have a full-blown LAN PC.

Hardware Mole

Our myopic mole is always digging for the latest dirt in hardware. Here are a few choice nuggets.

NEXiO Puts New Turn On Pocket PCs

The last half of 2002 saw a fleet of new Pocket PCs arrive, all of which seemed to rehash the same tired four-button, 320 x 240 theme. In March, though, expect Samsung to take the Pocket PC in a new direction: sideways, actually. The forthcoming NEXiO S160 (\$749) will feature a 5-inch, 800 x 480 landscape screen plus integrated 802.11b networking, meaning you can camp in your favorite access hot spot and not worry about constantly scrolling to read a full line of Web text. The device runs on a 400MHz Intel processor, has 128MB of RAM and a CF slot, and weighs only 8.1 ounces. Options include a VGA-out adapter and a sweet clip-on keyboard that doubles as a protective cover. ▲

Samsung's NEXiO S160 takes Pocket PCs to the next level by integrating 802.11b and a full-width landscape orientation.



LG Delivers Really Cool Net Appliance

We've been hearing about Internet-enabled refrigerators for years. At last, LG Electronics (www.lgappliances.com) has finally delivered one. The LRSPC2661T 26-cubic-foot Multi-Media Refrigerator (\$8,000) is now on sale in Europe and America. The titanium-toned fridge features a 15.1-inch LCD on which the user can check email, surf the Web, leave messages for family members, and (with the help of an included remote control) watch TV. A built-in digital camera ties into the fridge's photo album software, and a little database program helps to organize recipes. Users enter information via either an on-screen keyboard or a stylus. The appliance won't track your expiration dates or use bar code scanning to help track your culinary inventory, but for a first-generation product aimed at early adopters, the fridge is pretty sweet. ▲

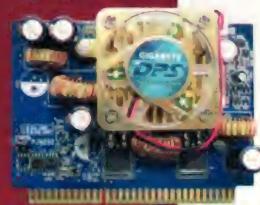
Gigabyte's DPS Beefs Up Mobo Power

Nobody likes to roast their hardware. Gigabyte's latest P4 flagship board, the GA-8INXP (\$259; tw.giga-byte.com), features a new, proprietary plug-in module called the DPS (Dual Power System) designed to help high-speed processors cope with their heavy power needs.

"Our thermal scan and probe showed excessive heat to the MOSFET components of the voltage regulator when overclocking the processor," says Gigabyte product manager Gary Tam. "The VR portion of the motherboard regulates the current from the power

supply. When overclocking the Vcore of the processor, more current is drawn from the VR, thus producing more heat and accelerating component failure."

The DPS operates in two modes. In backup mode, the module acts as a surge protector so extreme power draws only damage the DPS. In parallel mode, the DPS spreads the power from a normal three phases to six phases, resulting in lower temperatures and greater component longevity. ▲



To continue the tradition established way back in July 2002, we bring you a page of the choicest chip news. Enjoy!

Smart Displays Require Smart Microprocessors

Microsoft isn't the only company getting excited about smart displays. The new flat-panel displays Microsoft pioneered can be detached from a computer and still remain connected to the PC wirelessly through high-speed Wi-Fi connections, allowing a user to sit on the couch and surf the Web on the flat panel while watching TV. (See "ViewSonic Makes Mira Real." on page 6) The displays have to use Wi-Fi chipsets, but they also need either Geode microprocessors from National Semiconductor or Xscale microprocessors from Intel. Michael Polacek, vice president of information appliances at National, says it's more efficient to process video in the display itself rather than use up a lot of wireless bandwidth transferring video from the computer to the display. Instead, the PC sends compressed video to the display via the wireless connection, and the processor in the display decodes the images and displays them on the screen. That gives the chip makers the chance to sell more than one beefy microprocessor per PC. ▲



National Semiconductor and Intel hope to cash in on wireless displays.



Swedish company shows off tiny wireless chips that can be tiny monitors.

A Big Brother Chip That Helps Doctors

The Swedish company Cypak recently introduced a tiny wireless chip product that could be embedded in paper and used to track whether patients take their drugs on time. Jakob Ehrensvar, CEO, figures this application is just one of a myriad of uses for the chips, which consist of tiny circuits that can be broken as easily as someone tears a piece of paper. By embedding a circuit in the paper packaging for a drug tablet, doctors can monitor patient habits. Whenever a patient opens a package that contains one dose of pills, the breaking of the paper and its attendant circuit trigger a wireless signal to the doctor's office, which would record the time of the day that the pill was taken. ▲

Newest Itaniums Won't Be Slouches

Intel keeps plugging away at the performance numbers for its Itanium family of 64-bit microprocessors. Although the first Itanium took years to produce, new members of the family are coming out more frequently and at more t up is a chip code-named Madison, which Intel described in a technical paper for an upcoming conference as running at 1.5GHz. This is a 50% increase over the current top-performing 1GHz Itanium 2, which the chip maker launched in July. The Madison chip will have 410 million transistors, compared to 220 million for the Itanium 2. At 374mm², the chip is smaller than the 421mm² Itanium 2, but the Madison will still burn 130 watts. The chip is set to debut in 2003. ▲



Watching The Chips Fall

Here's a rundown of the latest AMD and Intel CPU pricing information compared with initial release pricing.

CPU	Released	Original Price	Current Price	Last Month's Price
AMD Athlon XP 1600 +	10/09/2001	\$160	\$52	\$54
AMD Athlon XP 1700 +	10/09/2001	\$190	\$58	\$66
AMD Athlon XP 1800 +	10/09/2001	\$252	\$64	\$72
AMD Athlon XP 1900 +	11/05/2001	\$269	\$68	\$81
AMD Athlon XP 2000 +	01/07/2002	\$339	\$75	\$93
AMD Athlon XP 2100 +	03/13/2002	\$420	\$89	\$110
AMD Athlon XP 2200 +	06/10/2002	\$241	\$140	\$144
AMD Athlon XP 2400 +	08/21/2002	\$193**	\$181	\$185
AMD Athlon XP 2600 +	08/21/2002	\$297**	\$290	\$295
AMD Athlon XP 2700 + 333 MHz FSB	11/14/2002	\$349**	\$339	\$349**
AMD Athlon XP 2800 + 333 MHz FSB	11/14/2002	\$397**	\$397**	\$397**
Intel Pentium 4 1.5 GHz	11/20/2000	\$819	\$108	\$106
Intel Pentium 4 1.6 GHz	04/23/2001	\$294	\$114	\$114
Intel Pentium 4 1.7 GHz	04/23/2001	\$352	\$121	\$121
Intel Pentium 4 1.8 GHz	07/02/2001	\$562	\$135	\$135
Intel Pentium 4 1.9 GHz	08/27/2001	\$375	\$144	\$146
Intel Pentium 4 2 GHz	08/27/2001	\$562	\$160	\$153
Intel Pentium 4 2.2 GHz	01/07/2002	\$562	\$193	\$193
Intel Pentium 4 2.4 GHz 400 MHz FSB	04/02/2002	\$562	\$196*	\$186*
Intel Pentium 4 2.5 GHz 400 MHz FSB	08/26/2002	\$243**	\$248*	\$248*
Intel Pentium 4 2.6 GHz 400 MHz FSB	08/26/2002	\$401**	\$295*	\$386*
Intel Pentium 4 2.26 GHz 533 MHz FSB	05/06/2002	\$423	\$185*	\$191*
Intel Pentium 4 2.4 GHz 533 MHz FSB	05/06/2002	\$562	\$189*	\$186*
Intel Pentium 4 2.53 GHz 533 MHz FSB	05/06/2002	\$637	\$234*	\$236*
Intel Pentium 4 2.66 GHz 533 MHz FSB	08/26/2002	\$401**	\$299*	\$379*
Intel Pentium 4 2.8 GHz 533 MHz FSB	08/26/2002	\$508**	\$375*	\$457*
Intel Pentium 4 3.06 GHz 533 MHz FSB	11/14/2002	\$658*	\$658*	\$637**

* Retail price ** Manufacturer's price per 1,000 units

Other current prices, if indicated, are lowest OEM prices available through Pricegrabber.com

The Longhorn Rumor Mill

You won't hear it straight from Microsoft, but little leaks about Longhorn, the Windows follow-up to XP, are starting to pile up. Longhorn is expected to ship in 2004 and will be built on a wholly new foundation constructed from XML. NTFS will give way to a new file system optimized for terabyte-capacity drives. The OS will be the first to support PCI Express, the higher speed, more secure successor to today's PCI slot format, and will thus provide tighter hardware-to-software security. The look of Longhorn is expected to make an Aqua-like leap past XP, and many developers are touting the 3D elements of Longhorn's GUI, including transparent windows. SOHO workers will also appreciate that the synchronization capabilities of Longhorn will cover both handheld devices, as well as multiple PCs.

Intel's LFM Means Better Graphics For All

Believing that cooler computing experiences will ultimately result in more Intel processor-based PC sales, Intel has devised a next-gen graphics toolkit called Light Field Mapping and made it available via open-source license.

"My son plays Dungeon Siege, and it's a beautiful application, but all the colors are flat," says Intel spokesperson Kevin Teixeira. "The sword should shine when it comes out of the scabbard. That's what LFM is about.

Developers will be able, for instance, to scan 3D objects and not only capture their geometry but the way they reflect light. It's going to make objects shine and look realistic. Up until now, you could render something on-screen or create an animation clip, but the data files were just too huge, and the processing required was such that you couldn't do it interactively."

Intel will work with game developers throughout 2003 to start integrating LFM technology into tomorrow's titles.



Intel's open-source Light Field Mapping technology will help game developers bring big-budget lighting effects down to desktop PCs.

Software Shorts

Here are a few software tidbits we found just before press time.

Software Lets Deaf Use Cell Phones

Israeli start-up SpeechView (www.speechview.com) has devised software that installs to a PC, which in turn cables out to a cell phone. When a deaf person receives a call, the phone feeds the voice signal to the PC. SpeechView's LipCell product (\$125) converts the voice in real-time into an on-screen face that appears to speak the call's words, letting the deaf person lip-read the call. Additional visual cues help the reader differentiate between phonemes such as the voiced "m" and the unvoiced "p," both of which are visually identical. Such extra indicators help raise viewer comprehension from 35% to 85%, according to the company. As cell phone hardware advances in the coming years, expect the software to run directly on the phone without the aid of a PC. ▲



Read my lips: SpeechView's software lets the deaf and hard of hearing use cell phones by converting the caller's voice into an on-screen face so the listener can lip-read.

MS Servers Cheaper Than Linux?

According to a study conducted by IDC and commissioned by Microsoft, it is cheaper for companies to run servers based on Windows 2000 than Linux. IDC surveyed 104 North American IT managers, looking at total cost of ownership from hardware expenses to staff support over five years, and found that Linux was generally 10% to 15% more expensive for network, file, printing, and security

servers. Linux was less expensive, however, for Web servers. A Microsoft statement does note that "a significant concern when comparing costs of different systems is the 'apples to oranges' fallacy," meaning that the cost figures obtained for Windows 2000 should not be applied to Windows XP. ▲



Believe it or not, a recent IDC report shows that Windows 2000 servers are generally cheaper to run over time than Linux.



AOL's New Strategy: Is It Enough?

At its latest investor meeting, AOL uncovered its bold new plan for inspiring bottom line growth: make Time Warner content exclusively available to AOL subscribers, especially those using AOL-TW's high-speed broadband network.

Hmm, you may think. Wasn't this what AOL execs said back in the early days of the merger talks? Well, three years and an 80% drop in stock price later, talk is finally turning to action. AOL subscribers will soon have access to content from Time publications such as *People*, *Entertainment Weekly*, *Sunset*, and *Cooking Light*. While CNN video news is now a \$4.95 monthly fee to anyone,

AOL users will have free access. Members will be able to see and hear Warner-owned videos and singles before they are released to the mainstream, and there will be special content promotions on new release movies such as "The Lord of the Rings: The Return of the King" and "Matrix Reloaded."

In the three days following the announcement, AOL's stock price dropped 20%, signaling that analysts remain unsure if the long-promised cooperation between AOL divisions will be sufficient to not only persuade dial-up subscribers to switch up to broadband but also woo back ex-subscribers who sought their high-speed access elsewhere. If the strategy doesn't pan out over the next 12 months, AOL may find itself unable to halt its slippery tumble. ▲



Hate Speech Ban Draws Sour Words

Civil liberties groups are rallying in opposition to a measure in the Convention on Cybercrime (conventions.coe.int/Treaty/EN/projects/FinalCybercrime.htm) put forward by the Council of Europe, which comprises 44 European nations. While the original Convention signed in November of 2001 criminalizes acts such as hacking and computer fraud, the new measure outlaws "acts of a racist and xenophobic nature conducted through computer systems." These are defined as "written material, images, or other representations of ideas or theories advocating, promoting, or inciting hatred, discrimination or violence against individuals or groups, based on race, color, descent, or national or ethnic origin, or religion."

The proposal runs directly afoul of the United States' First Amendment protection of free speech, even if that speech is hateful or discriminatory. U.S. government support of the measure would enable European countries to demand that American ISPs cut off access to certain sites. Such content could range from sites denying the Holocaust to parodying British ministers.

Council of Europe members have been very slow to ratify and implement the Convention, but the simple act of approving the Convention demonstrates a difference in priority and philosophy between Europe and America. In time, European hate groups may seek out American ISPs as safe harbors for their messages, but the broader issue remains about how international jurisdiction on the Internet will be—or even can be—handled. ▲

Cars Get Connected

Chances are that your car audio deck doesn't talk to your GPS, which doesn't talk to your PDA, which doesn't talk to your alarm system, and so on. Now, Omron Corporation (www.omron.com) and Mobilecast (www.mobilecast.co.jp) are jointly developing a telematics application server for the car featuring a CDMA2000 1x module. This broadband-class 3G cellular connection will tie vehicles' many high-tech systems together and link them with the outside world.

"If you want to take advantage of several information services, you have no choice but to purchase and install a variety of equipment and gateways," said Omron vice president Hideki Masuda at the Omron/Mobilecast press conference in October. "But the need to acquire and utilize information while in the car is increasing immensely. [Our alliance] will satisfy users' needs by providing devices and services in such areas as entertainment, safety and security, and driver support."

The arrangement hinges on an in-car server and a remote data center for content distribution, both of which are linked by a 2.4Mbps cellular connection. The first service, called on-demand radio, will launch in May. The car's hands-free voice recognition system will let the driver or passengers request songs simply by asking for them. Other future services, many of which will be tied to the Internet, include maintenance reporting, antitheft monitoring, emergency support, and a slew of entertainment, commerce, and information services. The open telematics platform is currently only slated for deployment in Japan, although American companies may soon follow suit. ▲



et about having six providers for six different data services in your car. A Japanese pilot project from Omron and Mobilecast will link an in-car server with a remote data center to tie all your telematics services into one easy package.



Online Banking Now Rivals IM In Popularity

According to a recent study of more than 2,000 Americans by nonprofit organization Pew Internet & American life, people are cashing in on Net-based banking as never before. In 2000, Pew found that 14 million, or 17%, of all American Internet users banked online. By 2002, that number had skyrocketed to 37 million, or 32%—a 164% growth rate.



A recent survey shows that online banking popularity is exploding across all age groups, but especially young adults and the middle-aged.

Pew's study indicates that 10% of all American Internet users will conduct bank business online in a typical day, a number that falls only 1% behind instant messaging. ▲

HP Opens Factory Outlet On eBay

Looking for a hot deal on an iPAQ handheld or Evo desktop? Don't pay list price when you can get an unopened original or factory refurb for a fraction of the price on HP's new eBay site (www.stores.ebay.com/hpfactoryoutlet). eBay continues to rack up top-tier vendor accounts that find the auctioneer's stable of 55 million users a far more effective outlet path than selling direct.

"eBay is a customer segment we currently don't hit," Gregg Sholeen, director of strategy and planning for worldwide ebusiness at HP. "Our store has mostly refurb product today, and we may add end-of-line products later. But some of our competitors who currently sell on eBay have found that 60% or 70% of the customers who buy there are new customers who've never bought their products before. So it's a great customer acquisition method." ▲

Loose Strands On The Web

Looking for some new surfing destinations? Here are a few sites you may have missed.

Return To Ellis Island

Roughly 100 million Americans have ancestors who passed through Ellis Island when they immigrated. Between 1892 and 1924, 22.5 million passengers were processed and linked to their ship manifests. About 60 years ago, these manifests were microfilmed, and now nearly all of these records are available to search and view for free at www.ellisland.org. Visitors can purchase facsimiles of manifests, ship pictures, and scrapbooks, although shipping and handling fees run a bit high. ▲

Criminally Stupid

Whether it's watching TV shows devoted to the subject or simply winding up on someone's email list for the annual Darwin Awards, we all love to wallow in tales of the world's dumbest criminals. When you can't wait until the next prime time caught-on-video special, surf over to Dumb Crooks: Stories of Mentally Challenged Criminals (www.dumbcrooks.com). This extensive archive of real-life forehead-thumpers will leave you wondering why police find their jobs challenging. ▲

Global Congestion

You sit and twiddle your thumbs, feeling sure that practically anywhere in the world must have faster Internet response than where you are right now. Find out for sure at the Internet Traffic Report (www.internettrafficreport.com). Using servers spread out around the planet, the ITR offers five-minute updates on ping times and packet loss stats from scores of major routers on six continents. Your drop in surfing performance may be a figment of your imagination, but wouldn't you like to know for sure? ▲

BIOS Upgrades Available Online

Before you send another motherboard to the landfill, consider upgrading the BIOS and giving your PC a new outlook on life. Here are a few recently released upgrades. Check out www.cpumag.com/cpufeb03/bios to see our entire upgrade list.

Compiled by Marty Sems

Motherboard	File (Date Available)	URL
Intel D850EMV2	MV85010A.86A.0059.P21 (11/13/2002)	developer.intel.com/design/motherbd/mv2/mv2_bios.htm
Intel D845GVAD2	SV84510A.86A.0009.P05 (11/01/2002)	developer.intel.com/design/motherbd/sv/sv_bios.htm
Intel D845GERG2	RG84510A.86A.0022.P12 (11/20/2002)	developer.intel.com/design/motherbd/rg2/rg2_bios.htm
Intel D845GEBV2	RG84510A.86A.0022.P12 (11/20/2002)	developer.intel.com/design/motherbd/bv2/bv2_bios.htm
Intel D845PEBT2	BT84520A.86A.0015.P06 (11/14/2002)	developer.intel.com/design/motherbd/bt2/bt2_bios.htm

Compiled by Steve Smith

CLASSIFIED'S

THE **Job**
SEARCHUI Designer
Google

We always thought that one of the best things about Google was that it had little to no user interface, at least anything more than that simple search box that greets you at the home page. But even the simplest of things need attending to, and the folks at Google are in the market for a UI Designer. In this position, you would help design and "storyboard" the ways in which users interact with new Google products and recommend changes to the current interfaces. You'll need several years' experience in Web development and expertise in HTML and JavaScript. But listen to the perks you will enjoy at the "Googleplex": free lunch on weekdays and "all the snacks you can eat," weekly roller hockey games, and a gym and sauna. Still feel pressured? Relax. "Experienced massage therapists on site will melt your stress," claims the job benefits outline. Where do we sign up? Here at CPU, deadline demands mean that "stress management" is a five-minute vending machine break and an editor telling you (nicely) to "get a grip." ▲

RAW DATA

71.2
million

The estimated number of wireless gamers in the United States (mainly via next-gen cell phones) by 2007, which is up considerably from the 7 million U.S. wireless gamers in 2002.

IDC

110 miles

The height of the paper stack Google would produce if it printed all of the Web pages it indexes for searches.

Google

9,011

The number of overt digital attacks against registered Web sites in September 2002, up from 5,830 in August and a new monthly record for cyber hostility.

UK cyber-security firm mi2g

Palm Slaps Back & Sony Plays To Win

It ain't over 'til that last PDA is sold. After seeing its share of the handheld market devoured by

competitors such as Handspring and an increasingly popular PocketPC platform, Palm made a comeback in

2002. According to a November 2002 IDC report, the original PDA maker's market share of units shipped grew from 29.1% in Q3 2001 to 33.8% in the same quarter of 2002, enjoying 9.4% growth. But the big winner is Sony, whose Palm-based CLIE PDA now owns 14.4% of the market, up 276.3% since last year. For HP/Compaq and Casio, the news isn't as good, as you can see from the chart on the left, which compares the worldwide number of PDA unites shipped from Q3 2001 to Q3 2002. ▲



	Q3 2001 Shipments	Q3 2001 Market Share	Q3 2002 Shipments	Q3 2002 Market Share	Percent Growth
Palm	753,000	29.1%	824,000	33.8%	9.4%
HP/Compaq	320,000	12.4%	290,000	11.9%	-9.4%
Sony	93,000	3.6%	350,000	14.4%	276.3%
Casio	185,200	7.1%	100,000	4.1%	-46%
Toshiba	N/A	N/A	103,700	4.3%	N/A
Others	1,229,800	47.8%	768,700	31.5%	-38%

Worldwide PDA
Unit Shipments



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The new **AA.com** Now you know.

Xbox vs. PC: Fight!



Alex St. John was one of the founding creators of Microsoft's DirectX technology. He is the subject of the book "Renegades Of The Empire" about the creation of DirectX and Chromeffects, an early effort by Microsoft to create a multimedia browser. Today Alex is President and CEO of WildTangent Inc., a technology company devoted to delivering CD-ROM quality entertainment content over the Web.

It's easy to read about the exciting new 3D chips that have 100m+ transistors or the new 8X AGP bus and say to yourself, "WOW, that sounds really great." But a question you don't often hear is, "Why do \$200 game consoles sold in toy stores blow away the apparent video performance of the most expensive high-end PCs?"

This month I'm going to compare PC video architecture with Xbox video architecture to illustrate the differences in design that hold the PC's performance back. Before we begin, it is also important to understand some fundamental differences between the PC monitor and a TV set. A monitor is designed for close-up viewing of highly detailed information such as text, while the television is designed to display moving video imagery from a distance; as such, it has a much lower standard for visual precision than a computer monitor does. While both devices operate on the same premise, there are a few important differences. Computer monitors refresh every pixel element on the screen at 60 to 120fps. Television sets are "interlaced displays;" they refresh every other line of data on the screen at 60fps, or the full display at 30fps. A monitor illuminates phosphor elements on the screen one pixel at a time; a TV illuminates whole alternating lines of visual elements, allowing the colors to bleed smoothly among one another horizontally. There are 483 horizontal lines in a conventional television set, so the effective resolution is about 640 x 480.

The tendency of television sets to blur horizontally is important because for rapidly moving images, it looks better. PC games have to add image filtering artificially to duplicate this effect. Hence the PS2 doesn't support hardware filtering. The Xbox does filter because it uses a PC video chip. Lastly, a TV's color gamut (the range of colors it can display) is much more limited than that of a computer monitor. A computer monitor can effectively display 32-bit color; a TV's color gamut is a subset of the PC's and has only about 12 bits of precision.

Now let's ask an interesting question: How much video bandwidth does an Xbox need to play Halo on your TV vs. on a PC?

PC:

60fps x 1,024 x 768 x 32-bit color = 180MBps

Xbox:

30fps x 640 x 480 x 16-bit color = 18MBps

WHOA! The PC needs to generate 10 times as much video data as a console just to properly drive the display. Unfortunately, the calculation I just did doesn't tell the whole story. We haven't touched the really thorny issue of video bus bandwidth. The creation of a 3D image is an extremely complex process that involves building each frame, pixel by pixel, in video memory. 3D images are constructed a little like oil paintings; layer upon layer of color is built up on the canvas and gradually blended in many passes. Every pixel in a 3D image can get touched by the video processor dozens of times before it reaches its final color. The internal memory bandwidth needed to generate 180MBps of 3D

video for modern video games is on the order of 2 to 4GBps. To drive a dual-monitor system at 1,200 x 1,600 x 32 requires around 10 to 20GBps of internal video bandwidth. By contrast, an 8x AGP bus on a PC has a PEAK bandwidth of 2.1GBps.

This is where the PC architecture breaks down and \$200 children's toys (consoles) really kick its butt. The PC's CPU has its own local RAM and system bus. The PC's GPU sits across the AGP bus from the CPU with a redundant cache of its own local high-performance RAM. This duplication of memory and buses adds unnecessary expense to the PC design. PC RAM on the CPU side is single-access memory; it can't be accessed in parallel like console video RAM can. The RAM on the video chip, on the other hand, is dual-ported; it can be read by the GPU while the AGP is accessing it. The AGP

Why do \$200 game consoles sold in toy stores blow away the apparent video performance of the most expensive high-end PCs?

bus, in effect, creates a huge gulf between the CPU and GPU. They are essentially separate computers. Sending data from CPU RAM to GPU RAM is fast, but pulling data back across the AGP bus can force the GPU to stall, causing a noticeable frame rate drop. Thus, once the CPU has shipped data off to the GPU, it can rarely help out with processing again.

Contrast this with the Xbox, in which the CPU and GPU share the same pool of dual-ported RAM on the same bus. Both the CPU and GPU can hammer on video data in parallel. The Xbox memory architecture is actually broken into two parallel banks, each operating at system bus speeds, independently allowing a total peak bandwidth of around 6.4GBps. There is no OS or virtual memory management slowing things down. The result is that the Xbox probably sustains 75% of its peak bandwidth continuously. The CPU can augment the GPU and add features to it in software that may not be hardwired in. All of the Xbox's 64MB of RAM is video RAM shared by the CPU. The PS2, by contrast, has 32MB of RAM, 4MB of which is dual-ported RAM shared by the CPU. The Xbox and the PS2, to a lesser degree, can also store some large 3D data types, such as textures in compressed formats that the GPU can decompress on the fly, thus increasing effective video memory bandwidth another 3-5x.

The cheap PC configurations typically purchased by over 50% of consumers have it far worse than those of us who buy gamer PCs. They come with a cheapo video chip that has no dual-ported RAM of its own. The video chip has to share access to the slower system RAM through the AGP bus. This is not fast. The Intel i845G video chip you get with your bargain PCs today offers

about 1/10th the video speed of a modern ATI or NVIDIA GPU. This is the great tragedy to the PC gamer because it introduces an order of magnitude video performance gulf between us hardcore gamers and the mass market, which forces PC game developers to optimize their games for very low-end video requirements.



The gap in video performance on the PC can be seen in many places in PC games, but one of the most interesting places to look for it is in the shadows projected by animated characters in a game. Real-time shadow rendering is not consistently supported by the low-end video chips sold today and requires lots of video RAM. Some games add real-time shadows to a 3D scene by letting the video processor render a projected shadow, then passing it back *slowly* over the AGP bus to the CPU to filter, then across the AGP bus *AGAIN* to be added back into the 3D scene by the video processor. A modern CPU can easily handle this computing task, but crossing the AGP bus twice introduces a

staggering performance hit. So filtered real-time shadowing is often a feature you find as an "option" in the video settings of modern PC games, if they support it at all. The AGP bottleneck is also the reason you don't see real-time video mixed in live 3D scenes.

So why does a two-year-old console architecture like the Xbox sold for \$200 in KB Toys kick a modern PC's butt for gaming?

1. The PC starts off with a huge bandwidth disadvantage because of the demands of its display technology.

2. The Xbox has an incredibly powerful video architecture.

3. The Xbox CPU is not burdened with the baggage of running a giant memory and CPU consuming OS.

4. Every Xbox comes with a great standard video chip, but most consumer PCs are sold with a crippled video chip, which drags down the whole PC game market.

5. A shared memory architecture between the CPU and GPU lets both processors help with graphics performance, while even the fastest AGP bus on the PC is a bottleneck. The next time somebody tells you an Xbox is just a chopped-down PC, show them this column. They couldn't be more wrong.

Considering what consoles deliver for so much less money, there is no excuse for PCs to have such limited video support. If Intel were to do one thing to add value to its CPUs and drive demand for PCs, it should be to make sure that it is impossible for a consumer to purchase a PC at any price that doesn't have video capabilities surpassing those of a leading-edge game console. ■

*Email your thoughts to
TheSaint@cpumag.com.*

EXTREME HARDWARE

These Gizmos Don't Sing It, They Bring It

If Santa was good to you this year, you'll have all the Extreme Hardware you need to make the Earth move for your next date. You may not want to leave the couch afterward, nor your Odyssey XL that made it all happen, but you can't let the evening end without showing your date your TsuMo. If you're both feeling a little motion sick by this point, go get some air. Just don't forget to turn on your guard-dragon to watch the house.

by Marty Sems



Sanyo/tmsuk Banryu

The domestic guard robots at tmsuk just keep getting cooler. This time the company has teamed up with Sanyo on the Banryu, which means "guard-dragon" (about \$16,400 in Japan only; www.tmsuk.co.jp, www.sanyo.co.jp). Like earlier dinosaurish domicile denizens from tmsuk, Banryu can call its owner on a cell phone if it sees or hears an intruder. The owner can then use her cell phone over NTT DoCoMo's Foma 3G or PHS service to remotely control her robotic spy until the fuzz shows up. What sets Banryu apart is that it actually can smell something burning and alert someone to a fire. It also can sprint 15 meters per minute and cross 10cm gaps with help from sensors in its legs.

TsuMo Deluxe

If we ever struck it rich, our wafer-thin veneer of maturity would be the first thing to go. We would be like Richard Pryor's bratty friend in "The Toy" or Ricky Schroeder's dad in the old series "Silver Spoons" with outrageously huge toys everywhere.

And the TsuMo Deluxe (www.tsunamivisual.com) would be at the top of our list. Forget force feedback. This environmental video game system's motors toss you around with six-degrees-of-freedom motion. You may have seen the TsuMo in arcades; now picture it in your rumpus room, \$21,995 later (50-inch projection screen). A version with a 39-inch screen costs \$20,995. Two games come with either model.

The surround-sound cockpit bubble is nice and available in red, blue, or yellow. Unfortunately, the TsuMo's games are limited to a few motion-enabled Tsunami titles, such as Crimson Skies and the new Air Raid, for \$3,000 to \$3,500 apiece. But stretch out with your feelings, Luke—Tsunami is planning to release a LucasArts-licensed Star Wars game this summer.



Hypersonic Sound Beam

Ever wish you had a speaker that could direct sound at your ears as tightly as a laser channel's light? Yeah, it would be nice to be able to doff those headphones you wear, yet still listen to decent music instead of the pap piped into your office. The Hypersonic Sound Beam parametric sound generator (www.internationalrobotics.com) uses ultrasonic carrier frequencies and sophisticated distortion correction to transmit sound only audible within a narrow beam as long as 300 feet. Anyone outside the beam can't hear the audio, but you can hear it inside the beam as if a speaker were next to you. You even could aim audio across the room to reflect and disperse off another surface, adding a "speaker" where there really isn't room for one. The HSB emitter can be less than half an inch thick, and the first commercial units (\$800) should resemble boxes 3 inches deep. International Robotics recommends the HSB for hands-free cell phones, translations during international conferences, police and military communication, and scads of other important uses. Eh, who are we kidding? We'd use the HSB to throw our voices into that Boba Fett statue we picked up at the last dot-com auction.



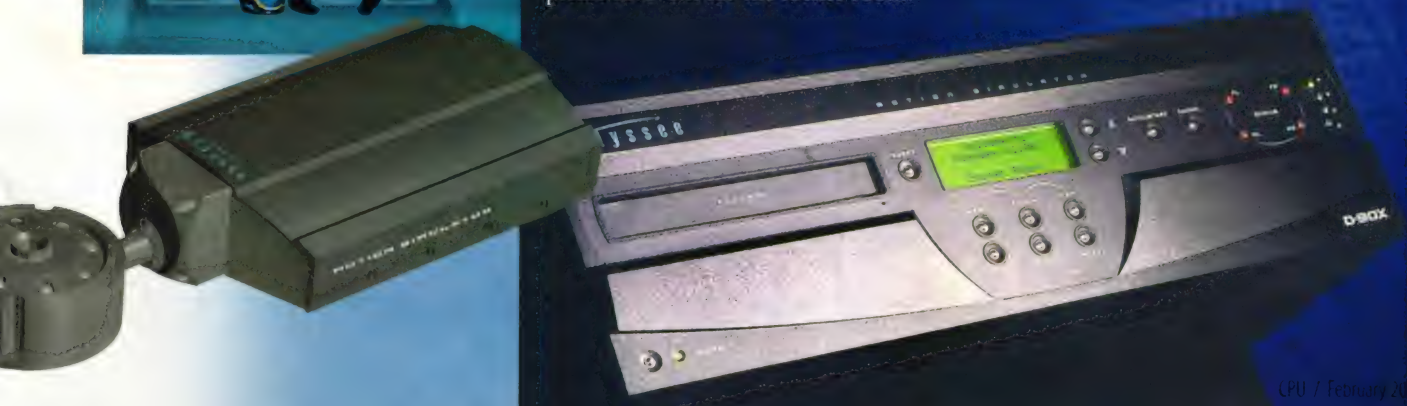
Konami Mocap Boxing

Here's another cabinet game you can take home and settle forever your assertion that you "coulda been a contender." In case you haven't played Konami's Mocap Boxing (www.konami.co.uk) in the arcades, you simply step into the "ring," put on your gloves, and start avoiding your opponent's fists. Overhead motion-capture sensors keep tabs on where your head is as you play, adjusting your perspective in the game, as well as telling you if your opponent is missing your maw or mauling your mug. While you're floating like a butterfly, don't forget to sting like a bee: The game keeps track of your own gloves as you try to KO the angry man hitting you. We're already thinking up force-feedback mods to try out on unsuspecting friends. You can buy Mocap Boxing new for about \$12,000 from dealers, such as Extremetoysforboys.com, or on the wholesale market for less than \$5,000 at www.coinopexpress.com. Just remember, you can play it in your boxer shorts at home, but we don't recommend it in the arcade.



D-BOX Odyssey XL

Want to really get into "Apollo 13," "The Matrix," or "Starship Troopers"? D-BOX's Odyssey XL is a beefier new version of its system that puts the "motion" in "motion picture" (\$28,000; www.d-box.com). Here's how your paradigm will shift: You play a movie DVD at the same time as an F/X Motion Code CD D-BOX supplies. The Odyssey XL triggers four electric jacks placed under your chair or sofa, which move you around like a Disney World ride to simulate the motion happening on-screen. Monthly F/X CDs supporting new movies are free for the first year, then cost \$500 per year after that. D-BOX lists nearly 140 movies its F/X CDs already support. If your favorite movie isn't among them, the Odyssey still can respond to audio events to give you a rumble seat. And yeah, we've already heard enough jokes about which movies the Odyssey should support next, so please save 'em for the locker room.



Upgrading your memory doesn't have to be complicated.



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\$42²⁹

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Price reflects an automatic 10% discount for ordering online. Prices may vary according to specific system requirements. The price listed was valid on 9/18/02 when we sent this ad to the publisher; however, prices may have dramatically increased or decreased since then. Visit the FAQ section of Crucial.com to learn more about why memory prices go up and down.

The Memory ExpertsSM

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Transmeta Astro



Although Transmeta isn't releasing pictures of its new chip, the lucky few who got to see it in a darkened room at COMDEX were given lapel pins with this logo.

Astro

Price To Be Determined
Transmeta
(408) 919-3000
www.transmeta.com
Preview: No Rating

Transmeta is the master of chip hype: Before its original launch, the company's Crusoe chip had the mystique of an NSA project deep from the bowels of black ops.

Based on a brief demo at COMDEX, the buzz is back, and with good reason. *CPU* was one of the first publications to see Transmeta's new Astro chip in action. Running at 1GHz, the Astro chip smoked a Sony GRX650 1.8GHz Pentium 4-M notebook in brief tests of WinXP application launches and system responsiveness.

Sure, there are a lot of ways to stack demos like that, and Transmeta isn't releasing many specs for its next-gen chip, also called the TM8000. For instance, we don't know what the chip's real clock range will be. When we sat down with Transmeta CEO Matthew Perry, he hinted that 1GHz would be somewhere in the range but that "you don't know which quartile that is." He also wouldn't release the price but said it'll be competitive. (One source told us to "think \$120.")

Astro doubles the instructions per clock cycle of the existing TM5800 chips with an

eight-issue VLIW (Very Long Instruction Word) unit instead of the previous chips' four-instruction-at-a-time system. Perry warned that we can't translate that into an even doubling of performance per cycle, as other architecture and I/O issues get in the way. But the TM8000's performance should provide bracing competition for Intel's new low-power Banias chip. TSMC is fabricating the TM8000 using a 0.13-micron process with copper interconnects.

We were struck by the Astro's small size and how cool it ran in our brief demo. We eyeballed it as only a bit larger than the existing TM5800, and the Astro has less than a third of the transistors of its major competitors, according to Perry.

Crusoe chips have previously been exiled to an ultra-portable and tablet ghetto. With Astro, the company wants to break into thin-and-light notebooks. Look for the chip to head to OEMs in Q3 2003 and for more information as it becomes available in upcoming issues of *CPU*. ▲

by Sascha Segan

ATI All-In-Wonder Radeon 9700 Pro



All-In-Wonder Radeon 9700 Pro

\$449
ATI
(905) 882-2600
www.ati.com



The All-In-Wonder series has always brought so much more than gaming to the table. ATI's latest, the AIW 9700 Pro, is not only the company's most ambitious AIW product yet, but it also sports the zippiest 3D performance in town, thanks to an R300 chip clocked at the same speed as the 9700 Pro. We previewed the AIW 9700 Pro in the December issue (page 19); this month we're back with benchmarks. As you can see, gaming is top notch and on par with a 9700 Pro, which had already stolen the performance crown from the GeForce4 Ti 4600.

The AIW's onboard Theater 200 single chip solution allows analog video and audio processing. With a new 2D comb filter and 12-bit ADC, playback and capturing of video and audio signals is superior in quality, with fewer artifacts than with previous AIW products. A nifty feature from the Stereo TV tuner with 125 channels is VideoSoap, which

uses the R300 chip's pixel shaders to reduce TV signal interference/noise during recording. A new Cobra MPEG-2 engine is on offer for MPEG-2 decoding and now encoding (a first), offloading functions from the CPU to the R300. Hi-Def addicts will lap up the component outputs supporting 480i, 480p, 720p, and 1080i. And you can control all of the functions via a nifty USB RF remote, just like a telly. The card's excellent software suite includes Multimedia Center 8.0.

Competition in this segment is not so strong, with the GeForce FX still unreleased and the new Personal Cinema product rumored to be some ways away yet. The AIW 9700 Pro is the most desirable graphics card out there now, especially if you are into gaming, as well as TiVO/ViVO and video editing functions on a PC. If 3D gaming is of less concern to you than price, you can always aim further down with AIWs from the past, such as the 7500 or the 8500. Two thumbs up. ▲

by Alex "Sharky" Ross

Wonder Of Wonders *Tested on WinXP Pro P4 2.53GHz

	AIW 9700 Pro	GF4 Ti 4600	AIW 9700 Pro w/ 4XAA
3DMark2001			
1,024 x 768	14220	12135	10520
Aquamark	45	34	30
Quake III	203	143	107
Jedi Knight II	123	107	78
Max Payne	84	61	77

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

ABIT Siluro GF4 Ti 4200 OTES

Many power users stretch their PC gaming dollar by buying and overclocking mid-level video cards. The Siluro GF4 Ti 4200 OTES is clearly designed with overclockers in mind. OTES stands for Outside Thermal Exhaust System, which refers to the card's unusual heatsink. It uses a heat pipe and exhaust fan to keep the GPU cool when you crank up the megahertz. This setup draws heat away from the GPU and blows hot air out of the back of your PC.

I didn't need to overclock this card to drum up good test scores. The Siluro GF4 Ti 4200 OTES's 3Dmark2001 score of 9,372 is hot for a Ti 4200. The card also shredded Quake III. The frame rate at 800 x 600 was 240.1fps, and it dropped a hair at 1,024 x 768, to 233fps. The big nosedive came at 1,600 x 1,200, in which the card's frame rate was 130.8. The Serious Sam test results were also impressive. I measured the frame rate at 82.6fps in the Karnak demo and 91fps in Metropolis.

I decided to see how far we could overclock the card before it became unstable. *Computer Power User's* trusty lab technician Sean Humphrey broke out the Raytek MT4 laser temp testing gun and measured the card's temps. We ran the card for an hour at each setting and then noted the hottest part of the heatsink. At the card's default clock setting of 275MHz, the temperature was a cool 106 degrees. We overclocked the card to 300MHz and measured the temp at 112 degrees. At 305MHz the temp was 113 and at 310MHz the temp was 114. (I sense a pattern here.) The 310MHz clock speed was the highest we could maintain before the card became unstable.

The Siluro GF4 Ti 4200 OTES is a pretty impressive card even before overclocking it. The fact that you can crank it up to Ti 4600-like speeds is a bonus. ▲

by Michael Sweet



Siluro GF4 Ti 4200 OTES

\$160

ABIT

(510) 623-0500

www.abit-usa.com



Hercules Gamesurround Fortissimo III 7.1

Computer games have barely caught up with 5.1 audio and already we're seeing 6.1 and 7.1 sound cards and speakers on the market. The Hercules Gamesurround Fortissimo III 7.1 will give Creative Labs' Audigy 2 a serious run for its money, as the Fortissimo costs a lot less but handles eight channels of audio and sounds great.

The Fortissimo III 7.1 uses a Cirrus Logic SoundFusion CS4624 DSP and has a decent signal-to-noise ratio of 88dB. I'd like that ratio to be closer to 100dB, but I can live with it. The card has a hardware polyphony of 64 voices. There are several inputs and outputs on the back of the sound card, including one for the front speakers, one for surround speakers, and one for the subwoofer. There's also a headphone-out connection, which doubles as an output for rear surround speakers if you're going with a 7.1 audio setup. The card supports several common audio standards, including Sensaura 3-D positional audio, Microsoft DirectSound, and EAX 1.0 and 2.0. It also supports Dolby Surround, Dolby

Digital, and Dolby Digital EX. The Fortissimo III 7.1 is compatible with Win98SE/Me/2000/XP.

The card includes several programs for playing and mixing audio and includes a control panel to tweak the configuration of the speakers and sound card. The control panel is well designed and easier to use than Creative Labs' control software.

I set up a 6.1 speaker configuration and fired up a few games and audio CDs to test the card. The games sounded really fantastic. This card does a great job of creating a 3D audio environment, which is an important aspect of any good game. The audio tracks sounded just as good.

The Creative Labs Audigy 2 may be a better choice for die-hard PC audiophiles, but for most users, including gamers, I think the Fortissimo III 7.1 is the better option. It costs less and sounds great. ▲

by Michael Sweet



Gamesurround Fortissimo III 7.1

\$49.99

Hercules

(877) 484-5536

www.hercules.com



Telex EV SonicXS 2.1



EV SonicXS 2.1

\$199
Telex
(952) 646-5134
www.telex.com/computeraudio



If you haven't heard of or seen the new EV line of speakers from Telex, you will soon. The company has just released three sets: two 2.1 systems and a 4.1 system. The Telex speakers are not the lightweight tiny boxes that are typical of computer speakers. These things are built like tanks and are nearly as heavy. I checked out the EV SonicXS 2.1 system. For the most part I was impressed, although I can't say that I think the speakers deserve their Klipsch-like price tag.

The first thing I noticed about the EV SonicXS 2.1 speakers was their size. The satellite speakers are far larger than typical PC speakers, measuring 9.5 inches high x 6.75 inches wide x 4.75 inches deep. The satellites are 30rms watts apiece, which is powerful for satellite speakers. The right satellite speaker has a headphone and an auxiliary jack on the right side so you can give your neighbors a bit of peace and quiet now and then. The only shortcoming I noticed was that the speaker cables were pretty short. I don't need to have these

big bad boys sitting right next to me. The subwoofer is also a monster at 15.25 inches high x 10 inches wide x 10 inches deep. The sub is 60rms watts, which is a pretty hefty amount of power for a 2.1 system. The speaker's frequency response of 45Hz to 20KHz is adequate.

I played a few games and listened to some CDs through the EV SonicXS 2.1, and I definitely felt the watts this baby delivers. This system makes your ears ring. If you want sheer volume, the EV SonicXS 2.1 is tough to beat. Playing Serious Sam was especially gratifying. The subwoofer pounded out the shotgun and rocket blasts, and the satellites sounded decent enough. The CDs sounded excellent, as well. The tonal quality of the satellites was right on.

I like the EV SonicXS 2.1, but I have a hard time swallowing the price for the system. Seriously, \$199? I could buy a set of Logitech Z-560s for that price and get surround sound. ▲

by Michael Sweet

Iomega Zip 750MB USB 2.0



Zip 750MB USB 2.0

\$149.99
Iomega
(888) 446-6342
www.iomega.com



I loved my reliable old Zip 100MB. It saved my assets more than once. But the Zip 750MB simply has too many "gotchas."

Despite its name, this Zip's \$12.50 to \$15 disks store only 717MB. Fair enough, as a \$1 CD-RW's 650MB capacity drops substantially when formatted with packet-writing software. But you can still burn data to CD-RW without packet-writing to get the full capacity, more or less, just like a 30-cent, 700MB CD-R. Had Iomega called the drive the Zip 720MB or something, I wouldn't have mentioned it.

In CD-RW terms, Iomega claims the Zip 750MB would have 50X/50X/50X (write/rewrite/read) speed ratings. This may be close to the truth with large files and small numbers of little files, but it wasn't the case with the 4,272 files in the 639MB folder we used to test CD-RW's until we enabled write-caching. (The disk's 16KB cluster size can leave a lot of unused space, so the drive

reported that it didn't have enough room for our 700MB folder.)

It took the Zip, as installed, 20:38 (minutes:seconds) to save 639MB, which is about 3.4X in CD-RW terms and nearly three times as slow as today's CD-RW drives. After we turned on WinXP Pro's write caching to compensate for the Zip's tiny 40KB buffer, saving 639MB took just 8:22. Iomega doesn't enable write-caching by default, as it makes it easy to turn off the PC and lose en-route data you thought was saved.

HD Tach reported average reads of 5MBps (6.3MBps maximum) and average writes of 1.4MBps (1.5MBps maximum) for the Zip's default configuration. Still, even if you need a replacement Zip drive to access your old disks, I would recommend buying a cheap 100MB or 250MB Zip and a CD-RW drive instead. ▲

by Marty Sems

Xoxide X450 PC Case

Xoxide is no stranger to the PC case modding scene, already offering a full range of aluminum beauties that come precut with windows and/or fitted with lighting. The X450 is the company's newest mid-tower ATX, which, at just above \$100, is aimed at the first-time buyer who wants to sample a premodded case on the cheap. Gussied up with an all-aluminum chassis, the X450 succeeds the X300 steel case in a lighter and more stylish form. And quite stylish it is, too, with a precut and stylized side window so you can show off your PC's guts with lighting and what not.

The X450 comes in black or silver, the latter of which seems to be the trendier-looking one. The aluminum makes the case lighter (only 9 pounds) and better suited where cooling and overclocking are concerned. Three preinstalled fans provide intake and exhaust airflow for your PC's components. Some higher-end cases come with more fans, but for the everyday user, three is more than ample, not to mention less noisy.

The front of the case sports some easily accessible I/O ports, including USB ports and speaker and microphone jacks. Assembling and upgrading a PC with the X450 is a doddle thanks to thumbscrews. The X450 didn't draw any of our blood when we put it to the test and threw together a system. Inside you'll find room enough for four 5.25-inch drives and five 3.5-inch drives, so space isn't really going to be an issue. A single intake fan on the front of the case cools the internal 3.5-inch drive bays. Tightly packed hard drives could benefit from a second fan, but that's part of cutting corners. At \$109, it doesn't come much cheaper than this for a fancy case, even if the aluminum itself doesn't appear to be of the same standard as more expensive cases. Bear in mind, however, that you still have to accessorize with a power supply and that cold cathode lighting, which both cost extra. ▲

by Alex "Sharky" Ross



X450

\$109

Xoxide

(866) 496-9433

(610) 353-1634

www.xoxide.com



Toshiba Pocket PC e335

Toshiba broke into the PDA market with the Pocket PC e740 (\$599), a workhorse that offers business and power users plenty of speed, internal memory, and the latest must-have feature: integrated Wi-Fi (802.11b) connectivity. With its new Pocket PC e335, Toshiba is targeting casual users willing to sacrifice a few features for a better price.

The e335's exterior closely resembles that of the e740; it's thin and light at 4.9 inches high x 3.1 inches wide x 0.4 inches deep and 5.1 ounces. The PDA includes a leather case instead of a flip cover, which I like because it protects the entire PDA. The reflective TFT color display boasts a 240 x 320 resolution. The display is clear indoors and out, and you can adjust the brightness to accommodate various lighting conditions.

You can expand the e335's internal memory (64MB of RAM and 32MB of ROM) by inserting an SD card. The e335 lacks the e740's CompactFlash expansion slot, which you may want to take into account if your digital camera uses CF cards. The 300MHz Intel PXA250 processor is 100MHz slower than the e740's.

The e335 also lacks the e740's best feature: Wi-Fi. In fact, it doesn't have any wireless connectivity at all. You can purchase a Bluetooth SD card (\$149.99), but you won't get the speed and range Wi-Fi offers. If you want to go wireless, you're better off with the e740.

If you do buy the SD card and have a PAN, you might find the included MSN Messenger and Pocket Internet Explorer handy. The e335 also includes several other worthwhile applications, such as Windows Media Player 8 and ArcSoft PhotoBase. You can use the Media Player to listen to digital music through headphones or the small speaker, which is noticeably louder than the e740's.

The e335 seems to fall somewhere between a casual and power user PDA. It's affordable, but it has just enough great features to make you want more. You can view information about the e335 at Toshiba's Web site, but it is only available through retailers. ▲

by Joshua Gulick



Pocket PC e335

\$349

Toshiba

(800) 867-4422

(949) 583-3000

www.toshiba.com



Toshiba PDR-3320



PDR-3320

\$329

Toshiba

(800) 550-8674

(949) 583-3000

www.toshiba.com



The debate about whether genetics or environment has a bigger impact on a child's development rages on. Toshiba makes a case for the genetics camp with its PDR-3320, the underdeveloped, adolescent, but more expensive version of the company's even more child-like, bungling low-end digicams. (See PDR-M11.)

Toshiba makes some good cameras, but this isn't one of them. At first whiff, the PDR-3320 smells like a good deal: It has a 3.2-megapixel sensor and 3X optical zoom, as well as a few manual controls for budding novices. From there, though, things get stinky in a hurry.

For one, Toshiba packaged only an 8MB SmartMedia card with the camera. I thought I was past complaining about getting short-changed on memory, but 8MB is a little ridiculous for a 3.2MP camera.

The 1.5-inch monitor refreshes at a snail's pace and features lots of graininess, too. The zoom is so slow that a flower bud might blossom

and fall off before you get focused. Also sluggish are shot-to-shot times, the flash-recharge rate, and startup/shutdown sequences.

Picture quality wasn't much better. In Auto mode, I noticed a lot of yellowing on indoor shots, and I also saw numerous chromatic aberrations. A lot of shots came out underexposed, and there were also a lot of blurred shots, thanks to the delay that occurs between a shutter button press and the actual image capture.

Even the manual mode was disappointing. Basic tweaking was limited to exposure compensation and white balance, and the long-exposure mode works only up to 2 seconds.

I could go on, but I'll spare you. This camera is a good example of why it's a mistake to save your money solely for the purpose of obtaining a 3-plus-megapixel camera. You'd be better off with a 2MP model that will give you more features and much-improved picture quality. ▲

by Nathan Chandler

Compex Wireless Internet Gateway Kit



Wireless Internet Gateway Kit

\$229.95

Compex

(800) 279-8891

(714) 630-7302

www.cpx.com



Looking to buy a hardware firewall, a 10/100 switch, and an 802.11b 11Mbps wireless network without having to piece together this and that? Consider Compex's new kit (part SKW811). It includes a NetPassage16 four-port 10/100Mbps switch and gateway, a WLU11A USB 1.1 802.11b adapter, and a WL11A iWavePort PC Card adapter.

Among the more mundane gear is a CAT 5 Ethernet cable, a serial

cable, and a power adapter.

Our kit also came with a second PC Card adapter, an Agere PC24E-11-FC/R, to help us test. We used one PC Card to turn the NetPassage unit into a wireless access point and put the other into an IBM X30 notebook. I've reviewed the NetPassage16 before, but this time we timed file transfers. We used a PC with a 1GHz PIII, 384MB of SDRAM, and WinXP Pro to send a 100MB

folder of mixed file types to the aforementioned notebook over various distances and obstacles. The NetPassage proved to be a distance champ, if not a major speedster. In an open-office environment with line of sight, it sent the folder over 10 feet in 3:38 (minutes:seconds), 150 feet in 5:42, and 250 feet in 7:16. Through steel obstructions and electric machinery in an adjacent warehouse, the Compex clocked 11:20 at 150 feet and 25:07 at 250 feet.

I listed some of the NetPassage's tempting features in my February 2002 review, but I'm disappointed that its WEP encryption still has only a 128-bit maximum strength. Setup was relatively easy, though. This kit has much clearer instructions than the NetPassage16's previous documentation and includes a quick setup poster. The kit also saves you at least 30 bucks over buying separate components, too. It's a very good buy. ▲

by Marty Sems

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

Casio Exilim EX-S2

There are lots of tiny digicams running around these days, all knocking each other around like scrawny street punks. The more refined and indisputable champ of diminutive digicams, though, is Casio's Exilim EX-S2, a 2-megapixel, credit card-sized beauty worth its weighty price.

The most notable aspect of the EX-S2 is its 1.6-inch color monitor. It's the first camera of this size that I've seen with this feature, and it's crucial because what good is a digicam without a screen to gauge how wonderful or atrocious the last shot was?

In most cases, my test shots looked very good. Distortion was low, and the only blown-out colors I saw occurred with bright objects in sunlight. The biggest problem I encountered was unfocused shots taken inside the camera's 1-meter range—you certainly won't capture any close-up pictures with the EX-S2.

In addition to adequate image quality, the camera has speedy performance. There was virtually no delay between shots, and even

when I used the flash, I waited only about four seconds to shoot again. Menus were colorful and logically organized, and there were plenty of manual options to help you improve shots, including exposure compensation and manual white balance.

Of course, to use these options, you'll have to navigate menus with the exasperating four-way thumb controller. This awful contraption is easily the camera's biggest weakness. I found myself cringing with frustration on multiple occasions because I was unable to use this infernal finger fumbler. You heard me.

Before using the camera, you'll have to charge the lithium polymer battery for about two hours. This proprietary cell won't endure an entire day of shooting; fortunately, a spare will only set you back about \$30. That's just one more positive for this tiny yet functional camera. In spite of the controller's flaws, I wholeheartedly recommend the EX-S2. ▲

by Nathan Chandler



Exilim EX-S2

\$300

Casio

(800) 435-7732

(973) 361-5400

www.casio.com



Pentax Optio 330GS

Three-megapixel cameras should conquer the market—just as soon as manufacturers can perfect them. If the Pentax 330GS is any indication, consumers might have to wait just a bit longer.

This camera's list price is nearly \$500, and from an initial peek at the spec sheet, that cost seems appropriate. You get a 3.2MP sensor and the typical 3X optical zoom lens, but you also receive a foldout LCD monitor. Whether this feature is worth your time is a matter of debate.

The monitor is fluid and bright, though I'm far from sold on the idea of offering a hinged screen just for the purpose of taking pictures of myself at arm's length. Wouldn't it just be easier to use the self-timer or have someone else take the photo? I'll give Pentax credit for rounding out this feature, though: The company added a Reverse button on the monitor that flips the scene so that you can see exactly how your shot will appear when you take it. The monitor's

greatest failing was an annoying flicker that occurred whenever I accessed an on-screen menu.

The 330GS's performance was strictly average. Startup times were about four seconds, and shot-to-shot rates with the flash turned on were also four seconds. The zoom has plenty of zip and focused my subjects in a hurry.

Image quality was far less striking. Under fluorescent lights, the auto white balance picked up a lot of yellow tones. Chromatic aberrations were present but not overly noticeable. However, the barrel distortion was very distracting, giving a lot of images distinct, curvy edges.

If you're looking for the most well-rounded 3-megapixel camera for less than 500 bucks, you'll have to look elsewhere because this isn't it. However, if you don't mind this Pentax's eccentric feature list, you'll be able to snag some pretty pictures with it. ▲

by Nathan Chandler



Optio 330GS

\$470

Pentax

(800) 877-0155

(303) 799-8000

www.pentax.com



Logitech Cordless Elite Duo



Cordless Elite Duo

\$99.95
Logitech
(800) 231-7717
(510) 795-8500
www.logitech.com



The Cordless Elite Duo is Logitech's most feature-laden keyboard and mouse combo. If you would rather use your keyboard than your mouse, the Elite Duo has plenty of feature buttons, shortcut keys, and dials to keep your hands on the board most of the time.

If you do have to use the mouse, you'll be sliding Logitech's MouseMan Optical, a full-bodied, four-button mouse that curves downward on the right side to conform to the shape of your hand. And if you didn't gather from the combo's name, the Elite Duo is wireless. It uses RF technology, which means you don't have to keep the combo lined up with the receiver, as long as you're within 6 feet of it. Now if you can just find a way to suspend the monitor over the La-Z-Boy. . .

Almost all of the Elite Duo's feature buttons and shortcut keys have small one- or two-word descriptions near the button or key. Even the main keyboard keys (that perform a function when you press CTRL) have short descriptions.

If you're a pro, you'll recognize the icons and won't need the text, but if the icon of three people stymies you, you can look below it to see that the button starts your IM service.

The wheel on the left side of the keyboard acts as your mouse away from mouse. You can roll the wheel to scroll vertically through Web pages and documents, and you can press the wheel to configure the wheel's scroll feature. The other buttons give you access to Internet, email, and multimedia functions. The Volume dial is much faster than volume buttons on other keyboards.

The F-Lock button transforms the function keys into shortcut keys. You can use them to control your email program (which you can start using by pressing the Email button at the top of the keyboard) or open high-traffic folders, such as My Documents. The Elite Duo is a stylish set; it has a comfortable mouse and all the right features. ▲

by Joshua Gulick

Microsoft Wireless Optical Desktop Pro



Wireless Optical Desktop Pro

\$104.95
Microsoft
(800) 426-9400
(425) 882-8080
www.microsoft.com



Microsoft is targeting its Wireless Optical Desktop Pro at "sophisticated" users who demand top-rung technology. The Desktop Pro includes a RF receiver and a wireless keyboard and mouse. The receiver sports USB and PS/2 connectors. The IntelliType Pro and IntelliPoint software makes installation easy and lets you customize the mouse and keyboard buttons.

The board is Microsoft's new Natural MultiMedia keyboard with a black and silver makeover. I like the ergonomic, split-key design. If you don't like split-key keyboards, consider the Wireless Optical Desktop (\$84.95), which includes a standard MultiMedia board. Even with the large (permanently attached) wrist rest, the Wireless Optical Desktop Pro's keyboard is light (under 2 pounds). I was just as comfortable typing with it on my lap as I was with it on the desk.

Several Hot Keys across the keyboard's top give you one-touch access to multimedia controls and Internet applications. Some Hot Keys shortcut to popular folders, such as My Documents

and My Music. The Function keys double as shortcut keys when you toggle the F Lock button. You can use the buttons to edit documents or send email. My only complaint about the keyboard is that the CAPS, NUMBER, and F Lock LEDs are on the receiver. If you don't keep your receiver visible, the lights are useless. I'm surprised Microsoft didn't put the LEDs between the keys, as it did to the Natural Keyboard Elite (\$44.95).

The Wireless Optical Desktop Pro includes the Wireless Optical Mouse. Its colors match the keyboard, and it sports a clear scroll wheel. I like the mouse, but I don't think it's the best mouse for this package. Experienced users will probably want at least one extra programmable button on the mouse. The Optical Mouse has plenty of room for an extra button on either side.

Aside from the LEDs and the lack of an extra mouse button, the Wireless Optical Desktop Pro is a solid combo. The keyboard is feature-laden and light, and the mouse is responsive. ▲

by Joshua Gulick

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Pro Lite 4821

\$1,058

iiyama

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(714) 437-5111

www.iiyama.com



iiyama Pro Lite 4821

What do you mean you haven't heard of iiyama? With 29 years of display-making experience, iiyama has emerged from its roots as a Nagano, Japan,-based TV-maker to an international manufacturer of computer displays with distributors around the globe. The company has been making great displays for the American market since 1991, and its new Pro Lite 4821 is one of the company's best.

Here are the salient specs: The Pro Lite 4821 is 19-inch LCD with an ultra-bright 600:1 contrast ratio, a maximum 1,280 x 1,024 resolution and 75Hz refresh rate, and a sharp (for an LCD) 0.28mm pixel pitch. The 4821 accepts analog (15-pin D-sub) and digital (29-pin DVI-I) input, weighs less than 20 pounds, consumes as much as 70 watts of power (not bad for a display of this size), and tilts 35 degrees in every direction.

The Pro Lite 4821 doesn't have an integrated TV tuner or speakers and doesn't

handle the same 1,600 x 1,200 or larger resolutions that 19-inch CRT monitors often do. But it is important to note that this display lacks only in those features; in terms of quality, this model is among the best 19-inch LCDs now available.

I used DisplayMate's Multimedia Edition diagnostic software to test the Pro Lite 4821 at its native 1,280 x 1,024 resolution and found absolutely nothing worth griping about. As for the individual test screens, notable standouts include ideal video bandwidth brightness (the video bandwidth index is 100 out of 100), text that's crisp in every font and size, and gorgeous color. I was especially impressed with how the display didn't fade or discolor at wide viewing angles and with how perfectly the display balanced light and dark. This one's a winner. ▲

by Cal Clinchard



EN-7500

\$599

Envision Peripherals

(888) 838-6388

www.envisionmonitor.com



Envision EN-7500

I love monitors that bear a simplified look, have display setting controls that you don't have to hunt for, and, above all else, come with an eight-page users manual. Envision's EN-7500 display fills this bill, and only two and a half pages in its eight-page manual are in English (that's a good thing). The EN-7500 is a multimedia-ready 17-inch LCD that provides users above-average imaging overall.

One downside to the EN-7500 is a low video bandwidth index (80 out of 100), as measured with our DisplayMate Multimedia display-testing software. This means that the EN-7500 won't provide you with the razor-sharp definition you might get from a higher-end LCD. The EN-7500 also doesn't accept DVI input, which would be nice when purchasing a big-screen LCD such as this. But these things are made up for in the monitor's \$599 price tag, which is good for a 17-inch LCD and even better for one with a built-in TV tuner.

Television, by the way, looked great on the EN-7500. An antenna/coaxial cable input jack on the back plus controls on the front that any couch potato would recognize mean the monitor is easy to set up and use as a TV. The monitor also has picture-in-picture and other TV-like features and comes with a remote control. The speakers delivered far better sound than you get from most LCDs (even many high-end models), but they still weakened at high volumes.

Getting back to the diagnostics, the monitor fared better than average when faced with most of the test screens. The EN-7500 really came through, though, when it came time to display some high-resolution images in Adobe Photoshop. Colors were rich and on-target, natural and artificial images looked realistic, and clarity was above par. If you want quality at a bargain, be sure to check out the EN-7500. ▲

by Cal Clinchard

Apple 17-inch Studio Display

There's no question that Apple's Studio and Cinema LCD monitors are great looking. The 17-inch Studio Display I reviewed, with its elegant yet sturdy design, was no exception. The real question is: Is it worth its \$999 price tag when most 17-inch displays (and even a few 19-inch displays) have been dipping well below the one-grand mark for some time?

I hooked up the display to a Power Mac G4 Dual Processor and tested it at its native 1,280 x 1,024 resolution. I used a variety of Mac OS X applications to view text and graphics, and I was consistently impressed with the display's crisp imaging and vibrant colors. Browsing the Web, looking at streaming video, and watching iTunes visualizations were all eye-pleasing experiences. The display also held up well during Quake III Arena gameplay, and "The Matrix" on DVD looked sharp and realistic.

Apple lists the digital-only display as having a 350:1 contrast ratio, which is good, but not as

good as they come, with top displays registering a bright 500:1. Still, the display seemed brighter than the contrast ratio spec would indicate. I also appreciated the wide viewing angle. Apple lists it as 160 degrees, which seems correct; the display maintained its image color and clarity even when I moved to the extreme left or right or viewed it from above.

With little in the way of extras (two USB ports, no speakers), limited control settings (brightness and power management only), and above-average (but not perfect) imaging, the display shouldn't cost as much as it does. But that doesn't mean it's not a fantastic display with plenty of screen real estate. Check the Apple site for system requirements before you buy, as there are specific Macs and video cards the display will work with. ▲

by Cal Clinchard



17-inch Studio Display

\$999

Apple

(800) 692-7753

(408) 996-1010

www.apple.com



Sony SDM-X52

Every month I review a hefty number of displays, and every time I see a pair of little speakers on the front bezel of an LCD I brace myself for dismal, tinny sound. Not so with displays such as the SDM-X52, a 15-inch LCD in Sony's new DeluxePro lineup. Somehow Sony manages to pump decent sound out of these small speakers. Not great sound, mind you, but far better sound than what most LCDs can offer.

But you're more interested in the SDM-X52's imaging capabilities, aren't you? OK, first let's dispense with the specs. The display's maximum resolution is also its native resolution: 1,024 x 768. I tested at that resolution with a 75Hz refresh rate. The display has a nice, bright 400:1 contrast ratio and a 0.297mm pixel pitch, which is fairly average for an LCD. It accepts both analog and digital input and includes all the necessary cables.

Using DisplayMate's Multimedia Edition diagnostic software, I found that the SDM-X52 could capably handle most test screens with

only a few exceptions. For example, I had to adjust the brightness to make extreme grayscale test screens look balanced, after which the display tended to over-brighten the brightest shades and over-darken the darkest shades. This issue wasn't readily apparent, however, when using Adobe Photoshop to view high-resolution images. Indoor images appeared in all their richness, and outdoor images were lush. Only the brightest portions of an image depicting sunlit tulips looked the slightest bit washed out.

The SDM-X52 has a perfect 100 video bandwidth index, and its precision also showed through when it depicted text of every font and size as razor sharp. If you need an inexpensive 15-inch LCD, you can find a better one for this price. But if you want digital input and speakers that won't make you cringe, the SDM-X52 is a great deal. ▲

by Cal Clinchard



SDM-X52

\$499

Sony Electronics

(800) 571-7669

(201) 930-1000

www.sonystyle.com



Samsung SyncMaster 172B



SyncMaster 172B

\$729

Samsung Electronics

(800) 726-7864

(201) 229-4000

www.samsungmonitor.com



The SyncMaster 172B is the latest installment in Samsung's ever-growing lineup of large-screen displays. If you can ignore its limitations (it only accepts analog input and has weak integrated speakers), it's difficult to imagine a 17-inch LCD that could produce better imaging than this display does.

It took our lab techs almost no time at all to unpack and install the 10-pound display on a test PC with an ATI RADEON 8500 All-In-Wonder video card and Windows XP Home Edition. The display also works with Macs. I performed my testing at the display's maximum/native 1,280 x 1,024 resolution and at a 75Hz refresh rate.

I ran DisplayMate's Multimedia Edition diagnostic program, and the SyncMaster 172B reacted kindly. It showed off its perfectly linear renderings of geometric test screens. It scoffed at the screen that detects stuck pixels. It rang in a nearly perfect 98 video bandwidth index (100 is the top mark), which indicates that its horizontal

brightness is almost perfectly matched with its vertical brightness.

I threw various fonts at the display and even sized some of them down to six points, and the display represented all the text with the utmost sharpness, thanks to a low 0.264mm pixel pitch. The SyncMaster 172B depicted color scales vibrantly and with even gradation from light to dark. The display did have the jaggedness that's common to most LCDs, though, when color combinations included green or cyan on magenta or red.

Using Adobe Photoshop 7, I viewed some high-resolution images. Highly decorated interiors appeared richly colored and absolutely beautiful in every respect. Natural images looked extraordinarily realistic. In short, the SyncMaster 172B offered me almost nothing worth complaining about. If you're looking for a 17-inch LCD and you can do without digital input, this display should be among your top considerations. ▲

by Cal Clinchard

Xerox Phaser 4400/N



Phaser 4400/N

\$1,399

Xerox

(877) 362-6567

(503) 682-7377

www.xerox.com



Users can get much higher printing speeds at lower prices than they could just a year ago. The Xerox Phaser 4400/N is a perfect example: a network-ready printer for \$1,399 that is manufacturer-rated at 26ppm.

The 4400/N has 64MB of standard RAM but allows for quite a bit of upgrading: You can increase the memory up to 256MB. The printer also has a 266MHz processor, 81 resident PCL fonts, and 39 PostScript resident fonts. An optional internal hard drive has 97 additional PostScript fonts. The printer supports parallel and USB interfaces, as well as 10/100Base-TX Ethernet.

Busy office places should appreciate the 4400/N's paper-handling capacity. The standard input trays hold 650 sheets of paper, and users can buy two optional 550-sheet trays, bringing the total input capacity to 1,750 sheets.

The 4400/N lived up to its speed claims when printing text at the default 600 x 600 dpi in our tests. A 100-page text document printed at a rate of 25.8ppm. Adding graphics slowed the printer

down a bit, with a text-and-graphics file printing at 18.8ppm and a PowerPoint presentation managing 15.4ppm. As expected, a full-page, high-resolution graphic (printed at a true 1,200 x 1,200 dpi resolution) slowed the 4400/N down to 8.3ppm.

This printer produced above-average prints, with clear, crisp text. More impressive was that despite fast printing speeds, clip art, charts, and high-resolution graphics displayed no banding at either the 600- x 600-dpi or the 1,200- x 1,200-dpi resolution. The only problem I noted in the print quality was a slight tendency for dark black graphics to be somewhat blotchy.

Three configurations of this printer are available, ranging from a \$999 base model to the \$2,699 4400/DX. Xerox's Web site details each configuration's specifications. With the 4400/N's many features, fast print speeds, and network capabilities, this printer should find a place in many offices. ▲

by Kylee Dickey

Voodoo E-class

When you think of top exotic gaming PCs, the first name that usually comes to mind is Falcon Northwest. But Voodoo PC has shown that it can compete with the big bird. The E-class PC that Voodoo recently sent us can hold its own against the Mach V (read the review in this section), and in a few ways, this system soars even higher than the mighty Falcon PC.

Specifications. Let's begin at the beginning, with the system's hardware. The E-class has a 3GHz Pentium 4 paired up with 512MB of PC1066 RDRAM, which is about as good a combo as you can hope for. The ATI RADEON 9700 PRO video card is king of the video card hill, at least until we see GeForce FX (and even then, the 9700 PRO may still be the better card. We'll see). Voodoo was kind enough to send along a customized red 22-inch NEC Multisync 1250+ monitor, which is sold separately for, well, we're not sure we want to know. Klipsch ProMedia 5.1 speakers are practically a requirement for a high-end gaming PC such as the Voodoo E-class. The system's Sound Blaster Audigy card orchestrates 5.1 audio beautifully.

The E-class we received had a sweet RAID setup, with a pair of 80GB Western Digital Special Edition hard drives. Perfect. Generally, I'm not a big fan of CD-RW/DVD-ROM combo drives, but the Plextor 20X/10X/40X/12X combo drive seems capable enough. A second optical drive would have been a nice feature, though.

The first thing that anyone will notice about the E-class is its eye-catching design. This system is available in a variety of hot colors, and the system Voodoo sent us was painted Tofosi Red. The system's Cooler Master ATC-710 case included the Eye of the Storm option, with a customized window and a pair of lights. The Voodoo E-class's fine appointments include a wireless Logitech keyboard and optical mouse, both painted to match the sharp-looking Cooler Master ATC-710 case.

Performance. The Voodoo E-class is so powerful that it almost feels like a personal

supercomputer. It crushed our benchmarks, even outscoring (just barely) a Falcon Northwest 3GHz system we recently received.

Let's check out the SYSmark2002 scores first. The system's total score was 294, which is simply amazing. The Internet Content Creation score of 405 is the highest I've seen, and the Office Productivity score of 214 is also impressive.

The PCMark2002 Pro numbers are eye-popping, as well, with a CPU score of 7,580 and a memory score of 8,012. Perhaps the most impressive score of all is the 3DMark-2001SE tally of 15,559. Amazing.

I almost felt silly running the Quake III tests on this machine because it deserves more of a challenge. Running Quake III on the Voodoo E-class is like asking Lance Armstrong if he can ride a bike downhill. Anyway, the Voodoo E-class throttled 316.9fps out of Quake III at a resolution of 1,024 x 768 and 198.5fps at a resolution of 1,600 x 1,200. Yeah, not bad.

I played around with Quake III for a while, and of course the game looked great, ran smoothly, and sounded excellent. I loaded up a copy of the Unreal Tournament 2003 demo and was thoroughly impressed with the quality of the gameplay, not to mention the excellent graphics quality. This demo looks especially good on a 22-inch screen. The system's sound quality was excellent at every turn, which is no surprise given the E-class's excellent sound card and speakers.

Final word. This is the first time I've seen a PC that I think can honestly compete with the best Falcon Northwest systems. The Voodoo E-class looks great, runs great, and sounds great. The price is also great, as in large, at more than \$5,000. With the customized monitor, the price skyrockets to about \$6,000. Time to buy more lottery tickets. ▲



Voodoo E-class

\$5,350 (without monitor)

Voodoo Computers

(888) 708-6636

(403) 264-4530

www.voodooopc.com



Features

Processor:
3GHz Intel
Pentium 4

RAM:
512MB PC1066
RDRAM

Hard Drive:
80GB Western
Digital Special
Edition (x 2)

Optical Drive:
20X/10X/40X
/12X Plextor CD-

RW/DVD combo drive

Connectivity:
Intel Pro/100 Ethernet

Chassis Type:
Tower

System Use:
Entertainment

Final Word:
The E-Class is good mojo.

by Michael Sweet

**XP-A/V Media Pro**

\$1,539 (without monitor)

CyberPower

(800) 707-0393

www.cyberpowerinc.com



CyberPower XP-A/V Media Pro

Here we have yet another high-end system from CyberPower, which knows how to put together a good-looking, high-performance machine for a low price. The XP-A/V Media

Pro has a base price of \$1,299, but the configuration that CyberPower submitted for my review came to \$1,539 sans monitor.

Specifications. The system has an AMD Athlon XP 2200+ CPU (a 1.8GHz processor that performs about as well as a 2.2GHz Pentium 4), with a 266MHz FSB, and a 256KB L2 cache. All this, plus one 512MB DDR memory module, sits on a Gigabyte VIA KT400 mobo.

CyberPower made some excellent drive selections for this rig, including a 120GB Western Digital Caviar hard drive. This is an Ultra ATA/100 drive that spins at 7,200rpm. The system also has a Plextor CD-RW drive that writes at 40X, rewrites at 12X, and reads at 40X and a Lite-On 16X DVD-ROM drive.

For my testing, CyberPower sent a ViewSonic E90f, a bright, heavy 19-inch CRT you can add to your shopping cart if you're buying the system via CyberPower's Web site. I appreciated having a high-performance monitor for the review, especially when I learned that the system contains the latest ATI RADEON 9700 PRO video card, an AGP 8X card with 128MB of DDR memory.

To bolster the system's multimedia power, there's a Creative Labs Audigy sound card. A six-piece set of Creative Inspire 5.1 speakers pump out pure Dolby Digital SurroundSound.

The system includes a modem (a Creative Labs V.92 Fax Modem) and NIC (Realtek RTL8139/810x Family PCI Fast 10/100 Ethernet). Also on board are two serial ports, one parallel port, six USB ports (four USB 2.0), and two FireWire ports. There's also a standard multimedia keyboard and a roller-ball mouse with scroll-wheel.

The system's OS is Windows XP Professional Edition, and bundled software includes Roxio Easy CD Creator 5, Power DVD, WordPerfect Office 2002, and Norton AntiVirus 2002.

Design. I liked the look of the XP-A/V Media Pro's midtower case, a Thermaltake Xaser II Plus Aluminum model that's silver complemented with red. The input devices and speakers come in matching silver, which brings a nice cohesion to the overall design. The case has a side window, and red neon lighting glows from inside.

It's easy to get into the case (pull a handle on the side and pull the panel open), and there's plenty of room inside for upgrade-happy hands. You can also add or swap out drives without tools. The system's memory is upgradable to 3GB; there are three slots in all, and a 512MB DDR module occupies just one of them. The mobo has six PCI slots, three of which are free.

Performance. The XP-A/V Media Pro made a meal out of the hands-on tests that we run on all systems, big and small, such as watching a DVD movie ("The Matrix" looked great), playing an audio CD (Charles Mingus sounded like he and his band were in the room), and playing a few rounds of good old Quake III (202.2fps at 640 x 480; 169.2fps at 1,600 x 1,200).

Faced with SYSmark2002 benchmarks, the system wrangled in some decent scores: 231 in Internet Content Creation and 167 in Office Productivity for a 196 Overall score. Considering this system is built around an Athlon XP CPU, the SYSmark2002 scores are dang good. PC-Mark2002 Pro scores were even better: 5,450 for a CPU score, 4,148 for a Memory score, and 1,098 for a HDD score. Short sentence that speaks volumes: The system earned a 12,027 score in MadOnion.com's 3DMark2001.

Final word. For those who simply don't want to fork out the dough for a bigger-name system that's no better than something a smaller-name manufacturer can put together, CyberPower's systems are well worth looking into. And of the many systems you'll find on the company's site, the XP-A/V Media Pro is truly a top option. ▲

by Cal Clinchard

Processor: AMD Athlon XP 2200+

RAM: 512MB DDR

Hard Drive: 120GB Western Digital Caviar

Optical Drive: Plextor 40X/12X/40X CD-RW; Lite-On 16X DVD-ROM

Connectivity: Faxmodem; 10/100 Ethernet

Chassis Type: Midtower

System Use: Entertainment

Final Word: Great system for a low price, which is CyberPower's specialty

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

Falcon Northwest Mach V

Once upon a time, there were two things you could always count on: death and taxes. But if you ask me, there is a third thing you can now add to that list: Falcon Northwest. Falcon Northwest always sends us incredible systems, each one seemingly better than the last one, and each one better than just about any PC we'd dare to compare it to. The latest version of the Mach V that Falcon Northwest recently sent us is really a thing of beauty.

Specifications. I love the hardware that Falcon Northwest put into this system. For starters, the PC has a 3GHz Pentium 4 (running on a 533MHz frontside bus, of course). The 512MB of PC1066 RDRAM will keep your programs running smooth and fast. Falcon Northwest gave us twin IBM 40GB hard drives with a striped RAID setup. I am greedy when it comes to storage, so I'd prefer larger drives, but 80GB is hardly a paltry amount of storage room.

The system's multimedia hardware consists of some of the best products now available. You can't beat the ATI RADEON 9700 PRO video card, and the 19-inch NEC monitor (sold separately) that Falcon shipped with the machine is very sharp. The Creative Labs Sound Blaster Audigy sound card isn't the latest model available, but of course it sounds great, especially when it's connected to the PC's Klipsch ProMedia 5.1 speakers. I am a big Plextor fan, so I dig the Plextor 48X/12X/48X CD-RW drive that's included with the system. In addition, the 16X DVD-ROM drive is standard equipment for any decent PC.

The Mach V is wrapped up in a Cooler Master ATC 110 case, which Falcon Northwest dolled up with a custom Exotix paint job featuring the CPU logo. I'm tempted to send my car to Falcon Northwest to have it repainted because these guys know what they're doing.

Performance. The Mach V made a "Mach"ery (cheesy, I know) of our benchmarks. The system beat SYSmark2002 10 ways from Sunday with a total score of 282. The system's Internet Content Creation score

of 404 is just sick, and the Office Productivity score of 197 that the Mach V posted is just as impressive.

The Mach V did similar damage to the PCMark2002 Pro benchmark, charting a CPU score of 7,363 and a Memory score of 7,842. The system's 3DMark2001SE score of 15,201 shows that this machine will shred through 3D graphics without even breaking a sweat. We finished up our benchmark testing by running the Quake III benchmark. The frame rates the Mach V turned in were utterly ridiculous: At a resolution of 1,024 x 768, the frame rate was 314.3fps. At 1,600 x 1,200, the frame rate was 203.1fps.

I played a few rounds of Quake III, but of course that game isn't going to push this system too hard. So I decided to try out the demo for Unreal Tournament 2003. The game looked really gorgeous and ran as smooth as can be. Really, UT2K3 isn't that much of a challenge for this system either. Where's Doom III when you need it?

The system's audio is every bit as good as the video, of course. The huge Klipsch subwoofer combined with the excellent five satellite speakers makes it sound as though you're in the middle of a concert—or a shootout, depending upon what you're doing with your computer.

Final word. The Mach V is the kind of system that will make any power user weak in the knees, but of course there is a heavy price to pay for such an extraordinary machine. This rig will set you back \$4,000, and that's *before* you figure in the cost of the monitor. That's a lot of jack for a PC, but this system may be worth a second mortgage on the house. ▲



Mach V

\$3,910 (without monitor)
Falcon Northwest
(888) 325-2661
(541) 552-9169
www.falcon-nw.com



Features

Processor:
3.0GHz Intel P4
RAM:
512MB PC1066
RDRAM
Hard Drive:
40GB IBM
Deskstar X 2
Optical Drive:
Plextor
48X/12X/48X;
Toshiba 16X
DVD-ROM

Connectivity: Intel Pro
/100 NIC

Chassis Type: Tower

System Use:
Entertainment

Final Word: Falcon is still
flying high.

by Michael Sweet

Intel Updates 2003 Roadmap



Anand Lal Shimpi has turned a fledgling personal page on GeoCities.com into one of the world's most visited and trusted PC hardware sites. Anand started his site in 1997 at just 14 years old and has since been featured in USA Today, CBS' 48 Hours and Fortune. His site—www.anandtech.com—receives more than 55 million page views and is read by more than 2 million readers per month.

It wasn't too long ago that Intel introduced their 3.06GHz Pentium 4 with Hyper-Threading technology. Upon its release, the processor was the fastest, most expensive, and biggest heat producer we had seen on the desktop. Intel took the Pentium 4 from 2.0GHz to 3.06GHz in less than 12 months in 2002, but now as we look at 2003, they are not going to be able to keep up the same clock speed scaling we've seen in the past.

Although Intel would like to be able to continue to crank out the clocks, physical limitations come into play, as moving beyond 3.2GHz on the current 0.13-micron process is quite difficult. Intel just recently updated their roadmaps to explain, in greater detail, what their plans are for 2003, and I'd like to spend a little time dissecting them.

From what I've seen, 3.20GHz won't be a reality until the second quarter in '03, and the year will close out at above 3.40GHz. With only an ~10% gain in clock speed over the course of 2003, this opens up an avenue for AMD to step in with Athlon 64 (formerly known as ClawHammer) and pick up some lost ground.

In order to make up for the fact that they will not be able to scale in clock speed as much as in this past year, Intel will be reintroducing Pentium 4 CPUs as slow as 2.40GHz and arming them with new features. These new features are no less than an 800MHz FSB (200MHz Quad-Pumped vs. the current 133MHz Quad-Pumped FSB) and Hyper-Threading support. The new CPUs will be available in speeds ranging from 2.40GHz up to 3.20GHz and, when coupled with Intel's new chipsets, should offer some pretty decent performance gains.

In the second half of 2003, depending on the maturity of Intel's 90nm process, Prescott will launch at above 3.20GHz with support for Hyper-Threading and the new 800MHz FSB. I've already talked about Prescott features in great detail in previous issues and on AnandTech, but it's no mystery that a 1MB on-die L2 cache is in Intel's cards for Prescott. It is their 90nm process that will allow Intel to aggressively scale Prescott clock speeds in 2004.

As I just mentioned, new chipsets will also be introduced to coincide with the 800MHz FSB Pentium 4s. A total of four new chipsets will hit the streets: Springdale-P, Springdale-PE, Springdale-G, and Canterwood. All four of these chipsets are dual-channel DDR solutions and support AGP-8X and Serial ATA; they differ in their FSB and memory support. Springdale-P will replace the current 845PE and will only support the 400/533MHz FSBs and dual-channel DDR266 and 333. Springdale-PE and G both support the new 800MHz FSB (as well as the older 533MHz FSB) and they are said to support dual-channel DDR333 and 400; Springdale-G adds integrated graphics.

Finally we have Canterwood, which is said to be a performance-optimized solution slated

to replace the 850E chipset. Information on the chipset code-named Canterwood is sketchy at best, but at bare minimum its specification list mimics the forthcoming Springdale-PE chipset.

In the end, Intel's 2003 looks to be an interesting year, but it also leaves a huge avenue for AMD to make a successful Athlon 64 launch. AMD has had a number of issues bringing the Athlon 64 to market, but with clock speeds hovering just below 2GHz at the time of publication, AMD could easily take back the performance crown before Prescott launches at the end of the year. We've been hearing from motherboard manufacturers and chipset vendors alike that everyone is simply waiting on AMD to deliver the CPUs. The chipsets and boards are more than ready; solutions from NVIDIA, SiS, and VIA are up and running in almost every motherboard manufacturer's R&D facilities in Taiwan.

Although Intel has turned up the heat significantly this year, we may see a much more even battle in the first half of 2003 as both AMD and Intel lay their best cards on the table. Let's hope AMD can show up for this match as it wasn't able to make it when we all expected it to the first time around. . . . ■

**Intel's 2003
looks to be an
interesting year...**

*Want to talk smack with Anand? Write to
Anand@cpumag.com.*

by Alex "Sharky" Ross

Gear Of The Year

Did you get what you wanted for Christmas, Hanukkah, Kwanza, etc . . . last year? Since I'm assuming we're all geeks here, that means a five-pack of Y-fronts and woolly socks from Kmart isn't what we're looking for. I'm sure if you look back to last year, there were a few hits and misses where hardware and gaming was concerned. 2002 was quite a year for technological advancements: Processors broke 3GHz, and graphics cards now have 19.2GBps worth of memory bandwidth! So who says we're in a downturn?

I'm not going to present this column as something really important like the Oscars (cough), and I'm no Billy Crystal, either. Even though I can do a better "whoooooAAAr" than Mr. Crystal, I'll get straight to the point and run down my top picks for 2K2. And who knows? If you take them seriously and nip out to the spring sales, maybe you might just treat yourself.

Technology. This one was a toughie. On the one hand, you've got ATI's R300 DX9-class 3D chip, which changed the way I played games. Not only do I play at insanely high resolutions (1,280 x 1,024 and above), but now I do so with anisotropic filtering and full-scene anti-aliasing (multisampling) turned on, as well. With 20GHz worth of memory bandwidth, I think we can all agree that this age-old bottleneck has been tackled head on. On the other hand, Intel broke 3GHz with its Pentium 4 3.06GHz with HyperThreading enabled. Although far from cheap, the performance is unmatched where processors are concerned, although nobody is really quite sure how to show off/take advantage of HT apps just yet. Oh well.

Chipset. In the past, a spot such as this one would have been reserved for the likes of VIA, Intel, or SiS (well maybe not them). Not in 2002. NVIDIA really surprised the heck out of press folks and consumers alike with its Socket-A based nForce 2 platform. No Athlon XP user (future or present) need look anywhere else. How do the guys in green pack so much groovy technology

into a single platform? Best-in-class performance, amazing onboard sound, decent graphics (if you want), and so much more on-board: I think it's safe to say that NVIDIA has really cracked the "on-board everything" idea once and for all.

Video card. This one is a cinch but it's pricey, so be sure to look under each and every mattress in your household before you head out to buy the ATI All-In-Wonder Radeon 9700 Pro. Not only does it come with an R300 clocked at warp speed for your gaming pleasure, but the plethora of TIVO/VIVO options puts the AIW 9700 Pro in a class of its own. Never before can I remember having amazing gaming performance and likewise top-notch video editing capabilities in the same AGP slot. Well done to the All-In-Wonder team.

PC case. Last year was a good year for PC cases. They all went aluminum, which helped for weight and cooling, and also got all dressed up and fancy-looking with lights and whatnot. But the winner for me had to be Shuttle's XPC, in particular the SB51G with its 533MHz FSB mainboard supporting P4s with HT and all in

a tastily dressed up tiny little box. Bravo!

Most-used stock phrase. Best Bang for the Buck. It seems I throw this one in on a monthly basis. But looking back, I see I've only ever used it when referring to AMD Athlon XP processors. Why? Because it's true. You can't get a better performing CPU for the price.

Surprise/disappointment. It's a funny 'ol game, as they say in England when referring to football (aka soccer), but the fact that NVIDIA's NV30 didn't come out in 2002 and ATI's R300 came out on time shows the duality of the graphics industry or something like that. I don't know that either company would accept an award such as this but at least for 2002, ATI and NVIDIA swapped positions where graphics technology was concerned. Another huge disappointment was that AMD's eighth-generation Hammer processors, which were originally slated

2002 was quite a year
for technological
advancements:
Processors broke 3GHz,
and graphics cards now
have 19.2GBps worth of
memory bandwidth!

Disrupting Reuters' newswire with a cheery Christmas greeting at age six, Alex "Sharky" Ross became an avid computer user/labuser, eventually founding popular hardware testing/review Web site SharkyExtreme.com. Exposing shoddy manufacturing practices and rubbish-spouting marketing weasels while championing innovative products, illuminating new technology, and pioneering real-world testing methods was just a front for playing with the best toys. The site acquired, he left in 2001. A London native and London School of Economics graduate, Alex currently swims in Silicon Valley.

for a 2002 release, did not see the light of day. Obviously there is more to come on this story. . . .

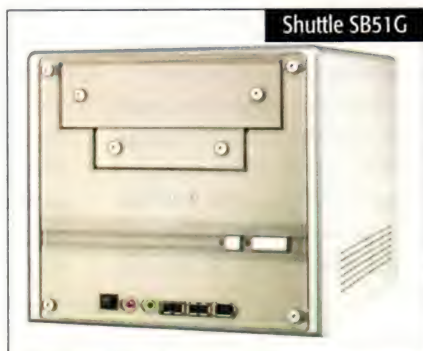
Marketing campaign. Hardware and gaming companies are renowned for coming out with dour and/or badly executed and tasteless campaigns. But this year is different and it's a no brainer (literally). Let's all thank Apple for its "Switch" campaign. As much as us PC users love to look down on all things Apple (except for the good-enough-for-James-Bond iPod), every time I or any of my geek pals in the industry see a "rumored to be under the influence" teenager explaining why you should "switch" from PCs to Apple computers, we all crack up. It seems like the Apple marketing department could be smoking the same stuff that the girl in said advert has been accused of. I think we can all agree Apple cases look good, but it's what's under the hood that counts, isn't it? And yes, Jaguar might well be the holy grail of OSes, but at least on the PC we can choose from a number of less reliable and equally overpriced and/or free setups.

PC game of the year. There are literally so many to choose from and to each his own, I guess. But for me it had to be Monolith's NOLF2. (See December's column on page 34.) Who says sequels are always worse than the original? Just take the red pill and follow the Empire Strikes Back method if you're a game developer in future.

Most disappointing PC game. This time last year, I was a huge fan of EA's engaging Medal of Honor WWII first-person shooter. It had me up for hours, days and nights, so I was so looking forward to the expansion pack Spearhead. What the bloody hell is up with finishing the last year of WWII in three hours? The Allies stormed the beaches and skies of Normandy and worked their way up to Berlin pretty hastily by anyone's standards, but in three hours? It took Steven Spielberg and Tom Hanks 11 hour-long episodes to reproduce that same year's events in the excellent "Band of Brothers" (which gets my vote for best DVD of the year, by

the way) on HBO. For \$30, I think we deserve a lot more, don't you?

Console game of the year. Metroid Prime for the Nintendo GameCube. (Yes, I know it's a silly looking box.) It's engaging. It's quirky. It's mesmerizing. It's addictive. It's immersive. It's gorgeous. It's possibly the best game I've ever played, and it's taken over my life for now and until I finish it and Samus takes her helmet off. And that's all I have to say about that.



Hardware Web site. When you're not reading CPU and crave more hardware happenings, the Web is the best place to go. There are plenty of useful sites. Yes I know, I'm friends with both Kyle and Anand, but without a doubt, both of these two characters deserve something for their hard work throughout the year, providing the community, which I once blotted myself, with top-notch content.

I've been there and I know it's a tough job, so congrats, guys. Hardocp.com and Anandtech.com get my nod (but not Uncle Albert's because it's all too complex for his tastes).

Gaming Web site. Now here's an easy choice. Let's see, us gaming geeks need a free, reliable, daily source for news, patches, updates, and reviews. What URL do we use? Ah yes, that would be www.bluesnews.com. This site has been around for years, and if the History Channel ever does a special on the Internet, I'm sure Al Gore, who invented the 'Net, would give credit where credit is due. Congrats Blue.

Celebrity hardware wedding. Samit Choudhuri & Julie Assmann. I'm sworn to secrecy as to the goings-on, but trust me on this one, it was a killer. Editor-in-chief wearing a dress with a smashing bride on the one side and a smashed nameless person on the other.

PR person. It was a tough race, but I think the PR person who swore the least at me throughout the year had to be NVIDIA's Brian Burke. I can't get you the P4 Bus license, but dinner is on me next time. I asked around, and the general consensus was that BB is 2002's top PR chap.

CPU is a fairly new magazine, and I'm not sure we have any silly trophies to hand out (Samit?) or a fancy ceremony to go with it, but it's the thought that counts, right? And in case you were wondering about the panel of judges, there was me, myself, and I and Uncle Albert. My cat Stinky was ever present and pressing keys on my keyboard, so props to him.

That concludes the awards ceremony. Happy New Year, folks, and well done to the winners. Hopefully I don't end up putting a curse on them. One of my resolutions is to have somebody really famous hand out awards to future winners. Anyone got the number for that Apple girl's agent? ■

Drop me a line at sharky@cpumag.com, and I'll put you down for front-row seats to the 2003 awards.

New COMDEX Stuffs



Kyle Bennett is editor-in-chief of *HardOCP.com*, one of the largest and most outspoken PC-enthusiast sites on the Web. *HardOCP.com* is geared toward users with a passion for PCs and those who want to get cutting-edge performance from their systems. Beware, though, Kyle is known for his strong opinions and stating them in a no-nonsense manner while delivering some of the most in-depth reviews and PC hardware news on the 'Net.

COMDEX in Las Vegas this year was an unstirred pool of stagnant technology. Seriously, from a hardware junkie's perspective, COMDEX was more than slow, but there were a few tidbits that made me smile.

NVIDIA has been asking us for a couple of months now, "Are You Ready?," in reference to NV30. The truth is that everyone is ready except NVIDIA. It did, however, launch its new flagship technology during COMDEX, but not actually at the show. The new card will be the GeForce FX, supposedly a meld of the GeForce and 3dfx names. Cool name, and even cooler hardware to see. Although no specs were given, the cooling system on this thing looks as though it would sufficiently cool a Ford Focus.

The demos shown were incredible, as well, as NVIDIA is truly moving toward "Cinematic Computing." Sadly, though, NVIDIA will be asking us if we're ready through next year, as it looks as though the earliest the card will launch in any quantity will be February—if it is lucky.

Of course, there are sure to be many flavors of the GFFX to come next year. You can read a full run-down of what little we know about the GeForce FX at www.hardocp.com/article.html?art=Mzkw. There are also lots of first-hand pictures to stare at on the last page. Just seeing the thing is really a kick in the pants. The card will actually stand up by itself.

Keeping on the NVIDIA track, we saw plenty of nForce2 mainboards by all the famous makers, such as ABIT and MSI. Neither of these guys, while showing off the boards, had samples for us as yet.

We have had samples from both ASUS and Chaintech, though. The ASUS board still has some issues accepting some of the NVIDIA driver set, while the Chaintech was so unstable we simply could not even get to a Windows desktop. Although we are still seeing issues with the nForce2, there's no doubt that it's going to be a force to be reckoned with if/when it makes it to market on a fully stable platform. The performance we have seen out of it is simply the best we've seen milked out of any AMD CPU.

On the rumor mill side of the nForce2 are two very interesting issues. First, it seems as though AMD's next-gen Barton CPUs are already being sampled out and some support a 200MHz FSB. It also seems that nForce2 is lined up to accept such a CPU "easily." Stellar performance and a clear upgrade path are making the nForce2 look better and better all the time. Keep in mind that VIA is working on its own KT400A chipset that will likely sport dual-channel DDR, but I simply think it's going to have to bring more than memory bandwidth to the table if VIA intends to compete with nForce2. I am a huge VIA fan, and AMD owes it a lot, but it looks as if NVIDIA is getting much more of a reach-around than VIA.

MSI and ABIT also showed us their Granite Bay (Intel's part number 7205—www.hardocp.com/article.html?art=MzIz) solutions that will officially support DDR266. Although we asked, we could get neither company to commit to being able to OC the memory bus asynchronously in reference to the CPU bus, although they did seem to think it could be done. Granite Bay boards will most likely cost between \$170 and \$250, as the chipset commands a premium, as it's a "workstation solution" not meant for the desktop. If you're planning on building an Intel board soon, this is one to wait on.

Not to be left out are the VIA and SiS' dual-channel memory solutions for the Pentium 4. VIA's P4X600 solution was promised to us for sampling in December, while SiS' 655 seemed to be on the same timeline. Both chipsets should support DDR333 and possibly DDR400 timings. Both chipsets are also being tweaked now to support Intel's Hyper-Threading technology.

All in all, Granite Bay boards are almost here for Intel, and nForce2 for AMD. As for a true gaming vidcard to hold you over till DOOM][, I suggest the Ti 4200 or 8500s that are still on the shelves for a holiday bargain or the 9700 Pro if you're feeling spendy. ■

... it looks as if NVIDIA is getting much more of a reach-around than VIA.

Talk with Kyle at kyle@cpumag.com.

Each month we ask a staff writer to take on our publication editor in a challenge to build the best PC for a certain price. Because our writers don't want to lose their jobs, they always accept this challenge willingly. Tempers will flare. Tools will fly. But only one will prevail.

This month the challenge is to build the **Best Gaming PC For Less Than \$1,000**

Samit

A gaming PC for less than \$1,000. Eh? Hmmm. (Reworded: My fave type of PC on a lackluster budget. Blech.) Well, I consumed weeks of thought (just hours in real-time) configuring systems with parts from vendor after vendor in an attempt to build a decent gaming system around the extraordinary ATI Radeon 9700 Pro. (Note that cards based on the GeForce FX were not available at press time so that wasn't even a consideration.) Well, if I'd lived near an NVIDIA facility, I could have called upon Tonya Harding's crew to waylay some poor sap and take ownership of his card. MUHAHAHAHAHAHAHAHA; it's with good reason I'm called the Insidious One. But hey, it's the holidays and my stomach is full and I don't have the fire (well, I do have a fire, but it's from a habanero burrito and a shot of holiday vodka) to be mean. Besides, I'm too pretty for prison.

Anyway, why be rude when you can be pleasant, right? So I decided to get creative (if you can call it that; my opponent redefined the word creative in his challenge) and I succeeded! Well, not really—it was all hunky dory until I noticed a missing OS and had to go back to the drawing board. Unfortunately, I didn't succeed in building a decent system around a 9700 Pro. Yeah, bugger; you took the word right out of my mouth! There were just too many compromises to make to a system if I used a Radeon 9700. I did build a gaming system that I would be willing

to play on myself (if on a similar budget). But as many of you know, it's hard to quench the thirst for power when you're building any type of gaming machine. We're not computer power users because we love to play with Burbies you know! <coff>

I settled on some core components: an MSI KT4 Ultra board, AMD Athlon XP 2000+/266, 256MB of PC2700 DDR, and wonderfully overclockable MSI Siluro GF4 128MB AGP 8X OTES in a windowed case to show off the interior. It never hurts for your case to look good at a LAN party. Alas, I made a mistake: I had assumed the mobo included an Ethernet adapter when it didn't and was forced to buy one at the last minute. Still, not bad being over budget because you could lop off either the Antec fans and gamepad or even the awesome Sidewinder Force Feedback 2 joystick (I had already chopped out the force feedback steering wheel in the interest of getting a faster CPU).

So there you have it. As this issue's hits newsstands shortly after the New Year, with some creative juggling, you will be able to swing an ATI Radeon 9700 Pro (especially if ATI drops prices to compete with the GeForce FX). ▲



Monitor not included

THE PC CHA



Samit Choudhuri
Publication Editor
Computer Power User

Component	Model	Price
Case	Pro Source Full Tower Model 602 COMET with side acrylic window and 300W P/S ¹	\$40
Motherboard	MSI KT4 Ultra ¹	\$105
Processor	AMD 2000+/266 with heatsink & fan ¹	\$93
Memory	Crucial 1 X 256MB DDR PC2700 ²	\$80.09
Hard Drive	Maxtor 80GB 7200rpm ATA133 ¹	\$108
Video Card	ABIT Siluro GF4 TI 4200 (AGP 8X, over-clocked) 128MB OTES with TV/DVI ¹	\$194
Sound Card	Integrated: C-Media 8738MX 6-channel audio + SPDIF out	N/A
Network Card	Netgear FA311 ¹	\$15
Modem	N/A	N/A
CD-R Drive	Lite-On 48/24/48 CD-RW (OEM) ¹	\$56.99
Diskette	Sony 1.44 FD ¹	\$8
Monitor	Not required for this challenge	N/A
Speakers	Logitech Z-640 5.1 ¹	\$66
Mouse	Logitech iFeel MouseMan Optical ¹	\$39.99
Keyboard	DIT Multimedia PS/2 ⁴	\$4.99
Operating System	Windows XP Home Edition (OEM) with SP1 ¹	\$93
Software	Nero 5.5, America's Army, PowerStrip Shareware, MSI WinDVD, etc.	Bundled
Miscellaneous	2 X Antec Blue LED 80mm Fans ¹	\$15.62
	Microsoft SideWinder Force Feedback 2 ⁴	\$80.99
	Logitech WingMan Rumble Pad ⁴	\$24.99
Subtotal		\$1,025.66
Shipping		\$32.56
Tax		\$5.95
Rebates		\$30
Total		\$1,034.17

Purchased From:

1 NewEgg.com
2 Crucial.com
3 CompuVisor
4 D.I.T. Corp

5 Buy.com
6 Amazon.com

*Items with rebate

CHALLENGE



6.

Marty Sems
**Staff Writer
Computer Power User**


Marty

I remember a party game from high school: Get as physically close to your date as possible without touching. I found that, man, it became much more fun once I stopped trying to win.

Want the "best" game PC? Buy the current top 3D card—the Radeon 9700 Pro, perhaps—then build an upgradable, stable PC around it. If you've been there, done that, and bought the T-shirt, why not make something different that will make your friends go "whoa"? I've been playing old arcade games with MAME32 recently, so I decided to build the Super Arcade/MAME Interplanetary Terminal (S.A.M.I.T.).

Some PC builders make PriceWatch their first stop. Mine was Menards. I bought some steel rods and acrylic sheets, then headed to Computer Renaissance for a cheap, refurbished CRT. Yeah, I know the Prime Directive said "no monitor," but it's a bear to play Galaga blind.

I MIG-welded a frame to enclose S.A.M.I.T.'s monitor and speakers, leaving room for a bigger LCD later. The Computecase desktop case went on top. I cut pieces of acrylic for S.A.M.I.T.'s sides and rear. Next, I molded a transparent lid for the PC with a heat gun and formed a free-standing marquee panel the same way. The marquee sits before the computer to give S.A.M.I.T. a more arcade cabinet feel, yet allows drive access when I remove it. Finally, I made

masking tape stencils of the CPU logo, Pac-Man, and a ghost and etched the panels around them with a sandblaster.

X-Gaming supplied the X-Arcade dual joystick console, which uses real arcade buttons and sticks. I topped S.A.M.I.T. off with a trackball for Missile Command, Centipede, and pointing duties, then installed MAME32.

S.A.M.I.T.'s coolness cost me, so I could only afford a GeForce Ti 4200. Fortunately, ABIT's Siluro with OTES (Outside Thermal Exhaust System) will handle FSAA and next year's games just fine. Plus, it has a liquid-filled heat pipe, a copper heatsink, and a 7,200rpm fan that vents outside the case, so you can overclock it to perform like a much more expensive card.

MSI's KT4VL mainboard supplies VIA's KT400/VT8235 chipset, 333MHz frontside bus support, and 8X AGP. All this upgradability means that I don't feel guilty about S.A.M.I.T.'s modest existing hardware. A DVD-ROM costs less than the Samsung 48X/16X/48X (\$44.99 after rebate), but the Samsung can back up game discs to CD-Rs for worry-free 48X reads.

True, I sacrificed some speed to make S.A.M.I.T. what he is, but I have zero regrets and zero tolerance for those vector-graphics tanks in Atari Battlezone, so you'll excuse me. . . . ▲



Component	Model	Price
Case	Compucase CI-7113 ATX desktop case ¹	\$47
Motherboard	MSI KT4VL (8X AGP, LAN, 333MHz fsb support, Bluetooth) ²	\$75
Processor	Athlon XP 2000+ boxed ³	\$86
Memory	Kingston 256MB PC3200 DDR SDRAM (overclocked) ⁴	\$70
Hard Drive	WD 40GB 7200rpm hard drive ⁵	\$64
Video Card	ABIT Siluro GeForce4 Ti 4200 OTES ⁶ 4X AGP 64MB	\$148
Sound Card	Integrated Realtek ALC650 6-channel	N/A
Network Card	Integrated VIA VT6103	N/A
Modem	N/A	N/A
CD-RW Drive	Samsung 48X/16X/48X CD-RW ⁷	\$74.99
Diskette	Panasonic 1.44MB ⁸	\$9
Monitor	14-inch Maxtech monitor (refurbished) ⁹	\$49.99
Speakers	Creative Cambridge CSW100 PC Works speakers and subwoofer ¹⁰	\$23
Mouse	MacAlly iBall Pro trackball ¹¹	\$6.99
Keyboard	DIT multimedia keyboard ¹²	\$9.95
Operating System	WinXP Home Full OEM ¹³	\$73
Software	MAME32, MSI Win DVD, Easy CD Creator, etc.	Bundled
Miscellaneous	X-Gaming X-Arcade Classic 2-player controller ¹⁴ ; 5/16-inch steel rods 24-feet, Lucite-ES bronze & clear acrylic sheets, Rubbermaid Toughstuff 20-x 48-inch shelving ¹⁵ ; 400W power supply ¹⁶	\$228.10
Subtotal		\$965.02
Shipping		\$50.99
Tax		\$13.91
Rebates		\$30
Total		\$999.92

Purchased From:

- 1 PCSupplySource.com
- 2 BuyXtremeGear.com
- 3 BuyAIB.com
- 4 Upgrade-Solution.com
- 5 CDRExpress.com
- 6 Best Buy
- 7 Amamax.com

- 8 Computer Renaissance
- 9 DIT Computers
- 10 Package2you.com
- 11 X-Arcade.com
- 12 Menards
- 13 Upgrade Center

*Item with rebate

And The Winner Is . . .

Some of you probably cringed when you found out this month's challenge parameters. Asking power users to build a gaming PC for less than \$1,000 is like asking a dog to sit nicely next to a steak dinner without drooling. Most people will tell you it can't be done.

Even the Insidious One couldn't find a way to fit the 9700 Pro into the budget even after weeks (OK, hours) of plotting. But despite these dire straits, both Samit and Marty came up with interesting and viable systems. Sure, neither is going to storm through any benchmarks (3Dmark: Marty, 9288; Samit, 10072), but they get the gaming job done and both (basically) came in under budget. Samit took the more traditional approach and went for the best hardware he could get for the money. His system, with its 5.1 speakers and cool "blue-light special" case is sexy, even if it isn't the fastest thing around. Marty's approach was brilliant. His arcade gamer shows some real creative thinking, and for that I think he deserves the win. But I'm also giving Samit the win. Yeah, he came in slightly over budget, but that \$34 was well spent on a system that, although not the best out there, is still very respectable for the money. So yeah, I'm declaring a tie, but I think that's appropriate here. To have two great but completely different creative interpretations of the same assignment is really what this thing is all about.


DE-TERMINATOR

Jennie "Don't bother me while I'm playing Pac-Man" Schlueter

Swappin' Parts

Back To The Basics

Each month in "Swappin' Parts," a Computer Power User writer upgrades one out-of-date component in our test machine. In December's CPU issue, we gave you a look at that test machine, an eMachines etower 600is. This month we begin upgrading it with a new case and power supply.

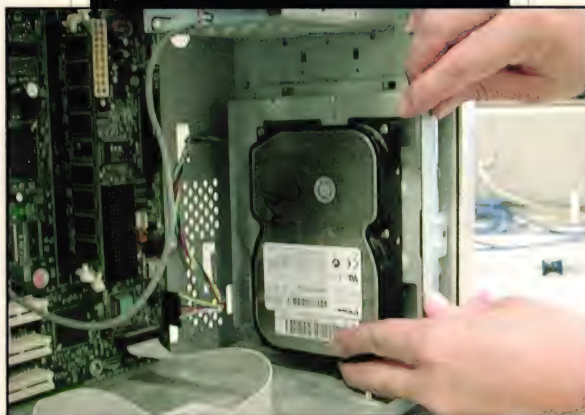
Last month we introduced our new "Swappin' Parts" project: the eMachines etower 600is from hell. The PC is in desperate need of a new, well, everything. (Our test machine still needs a name, and we're giving away a new Cooler Master 201b case for the winning entry. See more details at the end of this article.)

For our first upgrade, we could have chosen just about any component. A new hard drive would have been nice or a good sound card and some speakers. Perhaps a DVD-RW drive. But after careful consideration, we decided to start with a new case because the system's current case is way too small to accommodate our future upgrades. Not to mention that the current case is just plain ugly, and the "This Computer Is Never Obsolete" sticker eMachines pasted on its front is mocking me. We also decided to upgrade the system's power supply so we'd have plenty of juice for all the new gadgets we're going to add later.

Of course, PC cases are available in all sizes, colors, and configurations, not to mention price ranges. I wasn't terribly concerned about price when I was shopping for a case. Rather, I focused on the quality of the case (good), its size (big), and its design (cool). There are plenty of good, big, cool cases



Who mounts a hard drive like this anyway? eMachines, that's who.



Removing the hard drive from the 600is was a bit of a pain, but a trusty Phillips screwdriver did the trick.



to be had, such as the Lian Li PC-70 we bought for our previous test machine, MERLE, during our last "Swappin' Parts" extravaganza. I decided to try a different brand this time around. I was still partial to an aluminum case because they're lightweight, durable, and generally better looking than the plastic and steel boxes that make up the bulk of the PC case world. I found quite a few aluminum models with windows and flashy color schemes. I decided to skip a windowed case, however, because we can do this ourselves later.

I finally settled on a Cooler Master 201b, the same case one of our lucky readers will win in our "Swappin' Parts" Name That PC contest. The 201b is a well-built aluminum case with four 5.25-inch drive bays, two exposed 3.5-inch drive bays, and four hidden 3.5-inch drive bays, which will provide plenty of room for the upgrades we have in the works. The case is also loaded with fans: two up front, one built into the back panel, and one in the top panel. There are also a couple of USB ports hidden behind a little hinged panel on the front of the case. The only thing I really don't like about the case is its color, which is a sort of Tampa Bay Buccaneers pewter. It looks good on the Bucs' uniforms but not so good on the case. But we can fix that.

Next, I had to choose a PSU. It seems the debate about which PSU manufacturer is best is similar to which carmaker is the best.

The Enermax PSU's 431 watts of power gave our PC a big, and better, jolt.

Dodge, Ford, Chevrolet, Honda, and BMW all have their die-hard adherents (Samit being a *big* BMW fan). I am an Enermax PSU man myself, so I chose the EG465P-VE FCA PSU. This rock-solid unit has a variable-speed fan control and serves up 431 watts of power—that's more than enough electricity to power all the hot hardware that we will eventually stuff into this system.

**This PC
needs the
electrical
equivalent of
Viagra,
which it'll
get as soon as
I install the
new PSU.**

Out With The Old . . .

I set about dismantling the eMachines PC once I had the new 201b case and Enermax power supply. I unplugged the PC's power supply and disconnected the keyboard, mouse, and other components attached to the system. Next, I ripped the top off the old case and tossed it into the garbage. I was tempted to throw the rest of the PC in after the case, but it may be a while before we get a new motherboard, so I stayed my hand—for now.

The front panel of the case was removable, so I popped it off to get a better look at the system's drives and drive bays. I removed the system's ribbon cables first, followed by the CD-ROM drive, diskette drive, and hard drive. These bland beige components are going to look *so* bad in the shiny new case. The diskette drive has no faceplate of its own. It simply nests behind a built-in slot in the PC's case, which means it's going to look pretty goofy when we move it into the 201b. The hard drive was mounted to the inside front panel of the eMachines' case, rather than in a hard drive bay. It was a little tricky to remove because of how it was mounted (and because I have clumsy fingers, especially when they're wrapped around a Phillips screwdriver), but I managed to release it after a few minutes.

The eMachines' PSU was the next item to go. I checked out the PSU's specs after I removed it and found this little power plant generates all of 120

watts. This PC needs the electrical equivalent of Viagra, which it'll get as soon as I install the new PSU.

The last thing I had to remove from the motherboard was the modem, the sole add-in card installed in the system. This motherboard only has three PCI slots, so it's not like it has a lot of room for other components anyway. I ripped out the modem and went to work on the motherboard.

The mobo was pretty easy to remove. I unplugged the system's power switch cable, HDD LED cable, and power LED cable first, then unscrewed the eight or so screws holding the motherboard in place. I pulled out the little (and very dusty) motherboard and punted the old case into the dumpster.

. . . Into The New

I had to do a little cleaning before I installed the eMachines' old hardware into its new case. The motherboard and modem were pretty dirty, so I gave them both a few good blasts of compressed air. I lined up the motherboard inside the Cooler Master case and noted where I would install the mounting hardware for the mobo. I installed the mounting hardware, which only took a couple of minutes, and dropped the motherboard back in the case. The motherboard, including the input/output ports, lined up perfectly. I grabbed a few screws and secured the motherboard to the case. The smallish mobo looked kind of silly in such roomy confines.

Next I connected the power switch cable, power LED cable, and HDD LED cable to the motherboard. I couldn't connect the reset switch cable to the motherboard because the motherboard didn't

have such a connection, and neither did it have a connection for the PC speaker built into the bottom of the new case.

I plugged the modem into one of the PCI slots and then reinstalled the ribbon cables, followed by the CD-ROM drive, diskette drive, and hard drive. The CD-ROM drive's stylin' beige color scheme and rounded faceplate look terrible in this case, as does the diskette drive sans faceplate. I connected the ribbon cables to the various drives, leaving only the PSU remaining.

The Cooler Master 201b case includes a bracket for the power supply. I attached the bracket to the Enermax power supply we bought and threaded the PSU's cables through the opening in the back of the case. I lined up the bracket and PSU in the back of the case and screwed it into place. Finally, I connected the PSU to the motherboard and other components, including the three drives and the case fans.

I replaced the case's cover and reconnected the system's peripherals: monitor, speakers, keyboard, and mouse. I pressed the power switch, hoping that the motherboard wouldn't burst into a smoking mass of PCB jelly. It didn't. The system powered on just fine. Our transplant operation was a complete success.

On The Case

This month's upgrades didn't do anything to improve the power or abilities of our "Swappin' Parts" system, but they do pave the way for future upgrades. The old case was way too small. We will need a lot more room for all the devices we intend to install, and we'll need more power to run those devices once we install them. The new case and PSU are good starting points for our latest project. Next month, we'll start to dig into the PC's components and see if we can make something useful out of this salvaged system. **CPU**

by Michael Sweet

Our new "Swappin' Parts" system needs a name. That's where you come in. Send us the winning entry, and we'll send you a shiny new Cooler Master 201b case. Send your entries to swappinparts@computerpoweruser.com. We'll announce the name and winner next month.

X-ray Vision: The Areal Density Race

It's not yet as well known as was the race to 1GHz clock speeds for microprocessors, but the race to increase areal density for hard drives is intensifying. The goal of the race is to become the first manufacturer to break the 100GB-per-square-inch barrier for areal density.

Hard drive manufacturers continue to one-up each other as they increase the areal density of their drives. Areal density, or the amount of data a hard drive manufacturer can squeeze onto a platter's surface area, becomes increasingly important as manufacturers try to improve storage capacities while keeping manufacturing costs competitive.

With the diameters of hard drive platters fixed at 3.5 inches for desktop computers and 2.5 inches for portable computers, manufacturers cannot simply increase the size of the platter to squeeze more data onto the hard drive. Continually adding platters to the hard drive increases overall capacity, but it also increases the overall cost of the hard drive. Increasing the areal density capacities of hard drive platters gives manufacturers a cost-effective means of increasing hard drive capacities.

Several companies have recently announced key breakthroughs in areal density, all of which should eventually lead to the surpassing of the 100GB-per-square-inch mark for hard drives.

Western Digital

Western Digital announced in mid-2002 the industry's first 200GB hard drive that spins at 7,200rpm, the Caviar 200GB. Nicknamed "Drivezilla," the Caviar 200GB drive has an areal density of about 66.6GB per platter, or about 54GB per square inch. In September 2002, the company released a Drivezilla drive featuring an 8MB cache (rather than the standard 2MB cache), which greatly improves the performance of the drive.

In addition to its drives featuring high areal densities and overall storage capacities, Western Digital has made other recent strides in hard drive technology. In

November 2002, the company announced the market's largest external hard drive, the 200GB FireWire drive.

Maxtor

With its DiamondMax Plus 9 hard drives for desktop PCs, Maxtor claims to have increased areal density to as high as 80GB per platter, or around 64GB per square inch. Maxtor introduced the DiamondMax Plus 9 in late 2002.

The new hard drives, which are expected to appear in computers released in the first half of 2003, will feature a maximum storage capacity of 160GB.

Seagate

In late 2001, Seagate announced an experimental desktop PC hard drive that achieved an areal density of 100GB per square inch using AFC (antiferromagnetic coupled) technology. For a 3.5-inch platter, that would mean about 125GB of data storage. The company hopes to incorporate AFC technology in commercial products by 2003 or 2004.

Additional Seagate research, announced late in 2002, is making use of perpendicular recording technology to vastly increase areal density, perhaps as high as 1,000GB (or 1TB) per square inch. Perpendicular recording technology involves stacking the magnetic bits vertically on the surface of the platter. Technology usually used in today's drives stores bits horizontally on the platter, which requires more surface space. Using perpendicular recording technology would be similar to the city that builds skyscraper buildings in a densely populated downtown area, allowing more people to live in a fixed surface area than would be possible with single-story buildings.

In late 2002, Seagate said its researchers had achieved more than 100GB per square inch in experimental hard drives using perpendicular recording technology. Seagate hopes its perpendicular recording technology will appear in products as early as 2004.

The Glass Ceiling

Because of a few potential problems, researchers say areal density cannot continue to increase without a major change in the implementation of the technology.



As recording density increases (as shown in the bottom example), magnetic interference between the bits can affect the integrity of the data. Bits with a low recording density (shown in the top example) avoid problems with interference.



At some point, the bits will become so small that the energy generated by the internal temperature of the hard drive will equal the magnetic force of a bit and will be enough to alter the state of a bit. This problem, called the superparamagnetic effect, would make the drive's data unreliable. Researchers aren't yet sure at what bit size this effect will take place.

IBM

IBM announced late in 2002 that it has improved on its pixie dust technology (IBM's code name for AFC), resulting in the Travelstar 80GN hard drive for portable computers. At the time of its release, the Travelstar 80GN was the largest hard drive ever made for a portable computer at 80GB, and its 70GB-per-square-inch areal density also was the best mark for a 2.5-inch platter that is commercially available.

IBM announced pixie dust in mid-2001 with the introduction of a 25.7GB-per-square-inch areal density hard drive. With additional improvements to pixie dust, IBM hopes to break the 100GB-per-square-inch mark for areal density sometime in 2003. Once manufacturers reach that mark, IBM predicts 400GB hard drives for the desktop and 200GB hard drives for portable computers will be possible. IBM says pixie dust also eventually could lead to 2.5-inch platters appearing in desktop computers. (To learn more about pixie dust, see www.cpumag/cpufeb03/pixiedust.)

Fujitsu

Fujitsu has announced several improvements to areal density capacities for the 2.5-inch platters used in portable computers, but the company's most impressive

announcement probably involves changes to the read/write heads on the hard drives. By increasing the sensitivity of the heads, Fujitsu says the heads can read data from a platter with extremely tight areal density, perhaps as much as 300GB per square inch. Fujitsu says such technologies are still a few years away from appearing commercially.

Late in 2001, Fujitsu announced a technology called SF Media that it hopes will rival IBM's pixie dust in the areal density race on 2.5-inch platters. At the time, Fujitsu claimed creation of experimental SF Media hard drives that could store 106GB per square inch, but commercial products featuring such high areal densities haven't yet appeared.

Untapped Potential

We know that recent improvements to areal densities have occurred more quickly than expected, but to illustrate the point, consider this: IBM, in a 1998 research paper, predicted an areal density of 40GB

Areal Density's Growth

Increases in areal density for hard drive platters in commercial products have been steady since the introduction of the hard drive more than 45 years ago. However, increases in areal densities have occurred more quickly in recent years.

Year	Maximum Areal Density
1956*	2KB per square inch
1965	100KB per square inch
1971	1MB per square inch
1980	10MB per square inch
1992	100MB per square inch
1997	1GB per square inch
2000	10GB per square inch
2002	70GB per square inch

*Introduction of IBM's RAMAC (Random Access Method of Accounting and Control), the first hard drive.

Source: IBM

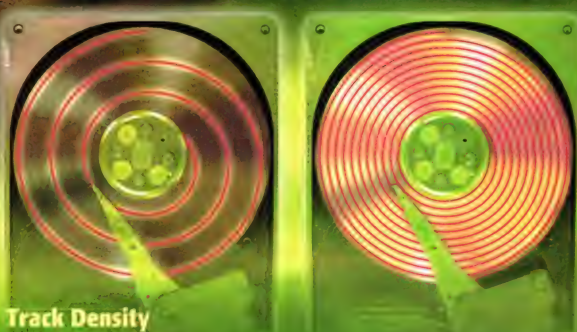
per square inch by 2004. Obviously, competitive research among several companies has blown away that prediction.

As researchers continually announce new areal density breakthroughs, it appears the race to break the 100GB-per-square-inch barrier has turned into an all-out sprint.

by Kyle Schurman

Increasing Areal Density

To increase areal density, manufacturers have two choices: Increasing track density or increasing recording density.



Track Density

Track density measures the tightness of the concentric tracks on the hard disk platter in tracks per inch. In the example on the left (which is not drawn to scale; a hard drive can have 18,000 or more tracks per inch), the spiral tracks are loose, which leaves more wasted space on the platter where data cannot be stored. In the example on the right, the spiral tracks are much tighter, providing more storage space for data.

Bit Length

1990: 12 micron track width, 0.60 micron bit length

1994: 4.8 micron track width, 0.27 micron bit length

1998: 1.3 micron track width, 0.094 micron bit length

2002: 0.25 micron track width, 0.03 micron bit length

Track Width

Recording Density

Recording density measures the tightness of the bits stored within the spiral track. Because the concentric circles are smaller in diameter in the middle of the platter and larger at the edges, manufacturers measure recording density in bits per inch per track. As you can see from the above graph from IBM, bit size has shrunk considerably in recent years, which allows the tracks to be narrower and greatly increases recording density.

Flat-Panel Screens

Plasma & LCD Technology Delivers On Its Promises

CRTs have been good to us over the years. Reliable, functional CRTs (cathode-ray tubes) have been the key to developing TVs and computer monitors. However, CRTs haven't been good for our backs. As we've migrated to larger and larger TVs and monitors, the bulky CRTs have caused plenty of strained backs. Just try finding a 30-inch or larger CRT TV that weighs less than 100 pounds today. (Then try wrestling it out of its cardboard and Styrofoam after you lug it home.)

Although CRTs remain dominant in the market, flat-panel screens represent the next generation in display technology. They're lightweight and thin, and they produce sharp, vibrant images. Two types of flat-panel screens are currently available: plasma and LCD (liquid-crystal display). Both types offer plenty of advantages over CRTs, but the high cost

of flat-panel screens as compared to CRTs has stunted flat-panel market growth thus far. Manufacturers hope continued technological improvements will bring down the cost in the next few years. Your back muscles hope so, too.

Plasma Basics

The idea behind plasma displays began at the University of Illinois in the mid-1960s. Early displays only produced a single point of light or a basic geometric shape. Monochrome plasma displays, used in commercial applications, began appearing in the 1970s. Color plasma displays first appeared in the 1990s, and manufacturers began using plasma screens in consumer products in 1999.

In a plasma display, tiny, colored phosphors illuminate in different intensities to create an overall image. Three phosphor colors (red, green, and blue)

combine to form a pixel in a plasma display. The combination of these three colors gives each pixel the ability to mix their intensities to create any color. A gas is used to excite the phosphor atoms and create the light. The gas consists of xenon and neon atoms, which are especially proficient at releasing light when they reach an excited state. Plasma displays are able to create vibrant, bright colors because the displays create their own light source.

Analysts traditionally have placed plasma display technology in the expensive, large-screen TV category (42 inches and larger). However, some major plasma display manufacturers, including Panasonic and Sony, have begun offering smaller plasma displays, including 32- and 37-inch models. Plasma displays will work as either a TV or a computer monitor, and manufacturers hope the smaller models

LCD Manufacturing Flaws

As LCD manufacturers increase the size of their screens, they often run into a frustrating problem: inevitable manufacturing flaws. Such flaws can render finished LCDs useless anywhere from 10% to 40% of the time, depending on the size of the screen. Obviously, such flaws lead to vastly higher manufacturing costs for large LCDs.

The manufacturing flaws that occur are inherent to the nature of LCDs. A 20-inch LCD with SXGA resolution would require about 4 million transistors. If as few as 0.01% of the transistors were defective, that would equal 400 bad pixels on the screen, which is far too

many for proper quality control. Obviously, manufacturing processes must be extremely precise to meet the necessary quality control for LCDs. Here are the three most common manufacturing flaws:

Optical. Optical defects include stuck pixels (which are always dark or always light), varying thickness in the liquid crystal layer, or foreign particles between the LCD panel and the backlight. Manufacturers can rarely fix optical defects.

Mechanical. Broken connections between transistors and broken glass in the LCD because of improper handling on the assembly line (and because of the fragile nature

of LCD technology) cause mechanical defects. Depending on the severity of the mechanical defect, manufacturers might be able to repair the screen.

Electrical. Most electrical defects, including flaws in circuitry or power supply, are easy to fix.

Larger LCDs are more susceptible to flaws because of the longer time they spend in the manufacturing process and the greater number of components included in the finished product. For example, an extremely large LCD might spend three or four days on the assembly line vs. one day for a smaller LCD, which

gives the larger screen a greater chance of picking up foreign particles or a greater chance of encountering a mechanical defect.

Manufacturing processes are improving, though, which should help increase the percentage of acceptable screens manufactured. For example, manufacturers have developed new methods of testing LCDs during the manufacturing process, letting them catch and discard severely flawed products before the entire process is completed. Minor flaws can be repaired earlier in the process, as well, allowing for a greater percentage of acceptable quality products. ▲

eventually will appeal to users seeking a dual-role display.

LCD Basics

LCDs initially appeared in 1968 when RCA introduced an experimental LCD. Several improvements to LCD technology have occurred over the years, allowing LCDs to become the dominant display technology in notebook computers. LCDs are ideal for notebook computers because they're lightweight and thin, and they conserve electrical power.

As LCD technology has improved, TFT (thin film transistor) LCD has appeared in large-screen, flat-panel displays. The images on TFT LCD screens are vibrant and sharp, making them work well for TV viewing and for computer monitors. TFT LCDs, also called active-matrix LCDs, provide better response times than passive-matrix

Flat-Panel Display Sales Outlook

Sales of flat-panel display TVs, including TFT LCD, plasma, and projection, should grow steadily in the next few years as improvements in manufacturing processes lead to lower prices.

	2002	2003	2004	2005
TFT LCD	3.76 million	5.27 million	7.24 million	9.8 million
Plasma	1.13 million	1.53 million	2.3 million	3.75 million
Projection	225,000	500,000	600,000	780,000
Total	5.11 million	7.3 million	10.14 million	14.33 million

SOURCES: SAMSUNG AND DOWNSIDE

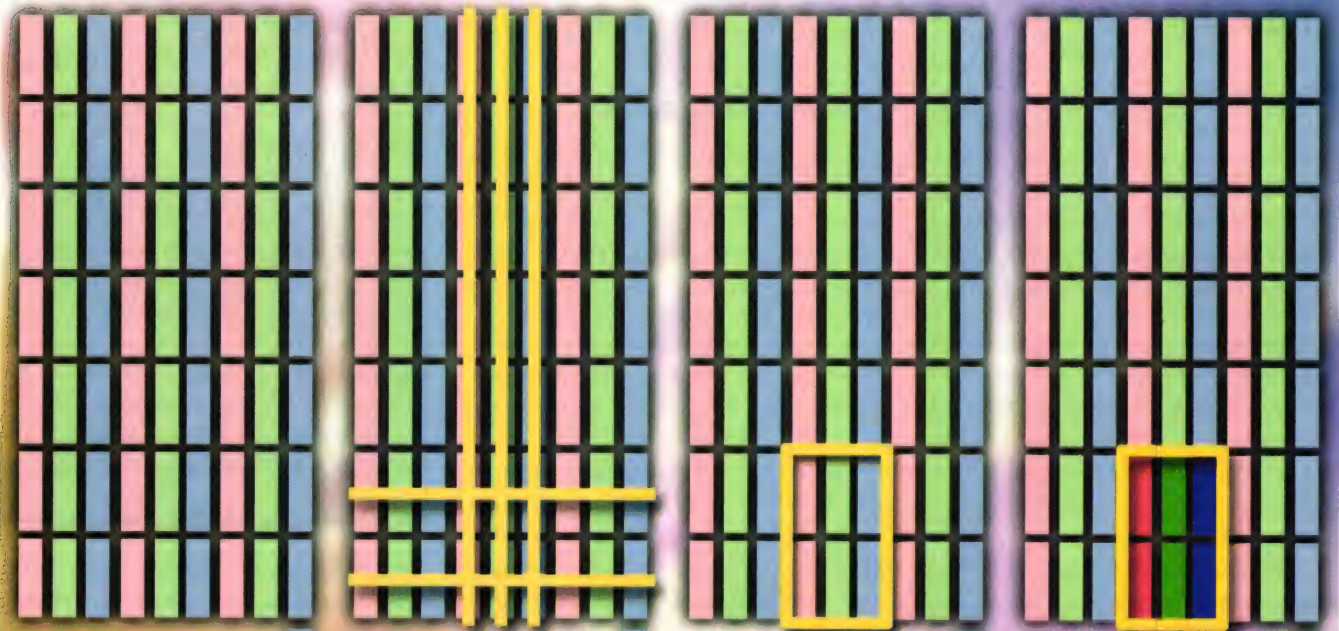
LCDs, giving them the ability to handle video motion. TFT LCDs also work well in tiny screens, some as small as 2 inches.

A TFT LCD consists of a grid of transistors and capacitors. Voltage is applied to a particular location on the grid, causing the pixel in the location to become bright. By varying the amount

of voltage, the TFT LCD can control the intensity of each pixel.

Samsung is one of the leading manufacturers of TFT LCDs, having created the first 40-inch screen a year ago. Before Samsung's 40-inch screen, many experts thought a 30-inch screen was the technological limitation for TFT LCD.

TFT LCDs At Work



The TFT LCD consists of tiny transistors and capacitors arranged in a grid on a glass substrate. Each cell in the grid represents a subpixel of red, green, or blue. The combination of three subpixels creates a pixel.

To activate a particular pixel, the row containing the pixel is given an electrical charge. A second electrical charge is applied to the columns containing the pixel. Where the charges intersect, the capacitor receives a charge, and the subpixels are activated.

By controlling the charge applied to each subpixel, the TFT LCD can control the intensity of the color the subpixel emits. When the three subpixels are mixed together, they can display any color in the spectrum.

SOURCES: SAMSUNG AND HOWSTUFFWORKS.COM

Consequently, many analysts have pigeon-holed TFT LCD as a technology that only will work as a computer monitor at sizes of less than 30 inches. However, Samsung's breakthrough will let the larger TFT LCDs compete with plasma in the flat-screen TV market. Samsung, which also manufactures plasma screens, says its large-screen TFT LCD eventually will last longer, use less power, and weigh less than comparable plasma TV models.

With some of its TFT LCD models, Samsung has created a hybrid picture-in-picture technology, letting you view a TV signal and a signal from the PC at the same time. Although Samsung's larger TFT LCD televisions weren't yet available for sale in the United States at the time of this writing,

Putting Plasma & LCD To Use

Although plasma and large LCDs are still too expensive for many consumers, they're finding homes in corporate environments and fulfilling many purposes. The following are a few examples.

Advertising. Using plasma and LCDs in a retail environment or corporate office grabs the attention of customers because of the sharp, vibrant images. The displays also can be viewed at almost any angle, which helps to attract customers on the move.

Conference rooms. Because they work well as computer displays and TVs, plasma and LCD displays are beneficial for conference rooms, which typically need multipurpose hardware. The lightweight displays easily can be moved from room to room, too.

Videoconferencing. Because videoconferencing projectors require darker conditions to achieve the best results and videoconferencing cameras require bright conditions, users usually end up with poor-quality video because of the contradicting needs of these two technologies. A plasma or LCD projects a bright image regardless of the exterior light, making it ideal for working as a projector with videoconferencing cameras. ▲

its 40-inch TFT LCD televisions was for sale in Japan in late 2002 at a U.S. price equivalent to about \$8,000 to \$10,000.

Out With The CRTs . . .

LCD and plasma displays offer several improvements over CRTs, which have existed for nearly three-quarters of a century and dominate the TV and computer monitor markets. CRT displays produce sharp images for a relatively low price, which has aided their continued popularity. But because of the technology used to create them, CRT displays are bulky and awkward to move. Even worse, as you expand the screen width of a CRT display, the length of the tube must increase, as well, increasing the depth of the CRT case and the bulkiness of the hardware.

Because plasma and LCD displays don't use a tube, they don't have the depth and bulkiness problems of a CRT display. A large-screen plasma display is typically 3 to 8 inches deep and 42 inches wide or larger, while a 17-inch CRT computer monitor is usually 18 to 24 inches deep.

. . . In With The Flat Panels

When it comes to the probability of plasma and LCD display technologies replacing CRT, it's not a matter of "if," but "when." The new flat-panel display technologies have too many advantages over CRT for consumers to ignore . . . well, consumers with plenty of money to spend, that is. Displays using flat-panel technologies currently cost several times more than CRT displays.

Currently, plasma displays start at about \$5,000 to \$7,500 for a 42-inch model. Larger, 60-inch models can cost \$15,000 to \$20,000. Samsung is offering a 17-inch TFT LCD television, which costs about \$1,500. For the extra cost of a flat-panel display, you do receive plenty of extra benefits over CRT displays. Images on flat-panel displays are brighter and sharper than on CRT displays, regardless of the exterior lighting conditions. Even with a larger screen, flat-panel displays weigh less than their CRT counterparts. You can easily mount a plasma display on

Flat-Panel Resolution Options

If you're planning to use a flat-panel display as both a TV and computer monitor, you'll want to be sure to purchase a flat-panel display model that has a native resolution that matches the resolution your PC operates in the majority of the time.

VGA (640 x 480)

This inexpensive resolution is the lowest available on the market today.

SVGA (800 x 600)

Many notebook computers make use of SVGA resolution; consequently, many flat-panel displays support it as a native resolution.

XGA (1,024 x 768)

Notebook resolutions are migrating toward XGA, although it's not yet as popular as SVGA. A flat-panel display with XGA native resolution will be more expensive than lower-resolution options.

SXGA (1,280 x 1,024)

Few computers make use of this resolution, unless high precision images are vital. Flat-panel displays with SXGA native resolution are among the most expensive available for purchase.

UXGA (1,600 x 1,200)

Very few flat-panel displays currently support UXGA as a native resolution because of low demand and high cost.

the wall because the hardware is extremely thin. Magnetic fields don't distort the image on a flat-panel display as they can on a CRT display.

Drawbacks

Flat-panel displays do have some negatives when compared to CRTs. But most of the flat-panel problems are avoidable.

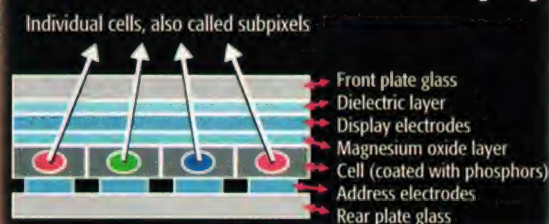
Resolution. With plasma displays, native resolutions can be problem.

Plasma Displays At Work

In a plasma display, hundreds of thousands of cells are laid out in a grid. The entire grid, which extends the full length and width of the display, is sealed between two pieces of glass. Within each cell, xenon and neon gas is trapped. Each cell is coated with phosphors and sandwiched between address and display electrodes, which run perpendicular to each other inside the glass. To light a particular pixel on the display, the plasma display's controller activates the portions of the electrodes that intersect over the proper subpixels. By charging the intersecting electrodes with opposite charges, the controller creates a flow of charged electrons moving through the cell. The electrons move the atoms in the gas into an excited state, causing them to emit ultraviolet light photons. The photons then interact with the phosphor atoms that coat the inside of the cell. The phosphor atoms move into an excited state and emit light photons that

are in the visible spectrum. The light from each subpixel combines to create the color of the overall pixel, which is seen through the front plate glass. The dielectric layer serves to insulate the display electrodes. The magnesium oxide layer provides additional protection for the electrodes.

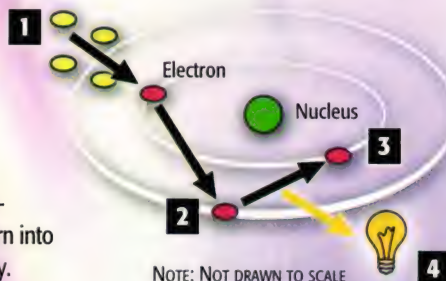
Cross-section Of A Plasma Display



NOTE: NOT DRAWN TO SCALE

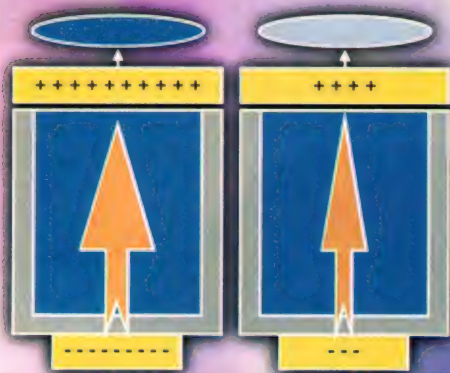
At The Atomic Level

As free electrons are quickly and violently introduced into the plasma (1), they collide with an atom, causing negatively charged electrons to break free. The atom now becomes a positively charged ion. Negative and positive particles in the gas then rush toward each other, causing additional collisions. The atoms move into an excited state, and electrons move into higher energy levels momentarily (2). As the electrons return to their original energy levels (3), they release ultraviolet light photons (4). These light photons eventually turn into the images you see on your plasma display.



NOTE: NOT DRAWN TO SCALE

Controlling The Intensity



By adjusting the pulses of electrons flowing through a cell, the display's controller determines the intensity of the visible light the cell releases. A stronger electron pulse creates a vibrant color; a weaker pulse creates a lighter color. The ability to control the intensity of the three subpixel colors (red, green, and blue) lets the display's controller create every color in the spectrum by mixing the three subpixels.

If you plan to use your plasma display in conjunction with a computer, you will need to make sure the plasma display can meet your PC's resolution needs. (See the "Flat-Panel Resolution Options" chart.) Many plasma displays can reproduce resolutions outside of their native resolutions, but the reproduced resolutions usually don't produce images as sharp or vibrant as they'd be in a native resolution.

TV tuner. Plasma screen displays are just that—displays. They don't contain a built-in TV tuner, as do traditional CRT televisions. They also don't usually contain built-in audio speakers. (Some offer audio speakers as an attachment option.) Many peripheral devices, such as a satellite TV box or a cable TV box, contain TV tuners, however. They usually can connect directly to the plasma display and can handle audio input, as well.

Burn-in. Plasma screens are susceptible to degradation and "burn-in" if a stationary image remains on the screen for a long period of time (similar to the earliest CRT computer monitors). Manufacturers recommend using a screen saver or reducing the screen's brightness if you're concerned with degradation.

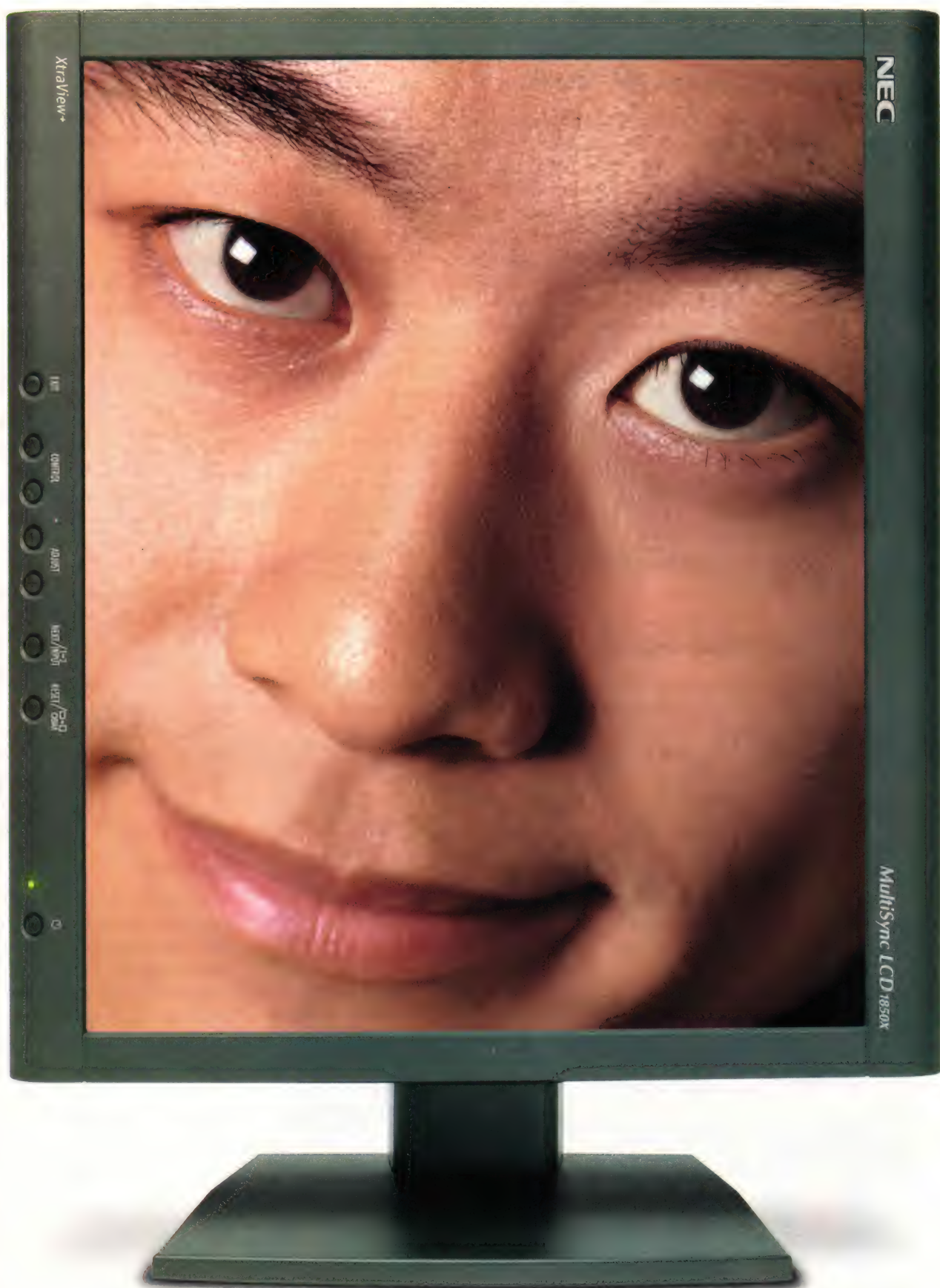
Temperature extremes. For LCDs, extreme temperatures can negatively affect the quality of the images on the screen. Normal temperature ranges in a home shouldn't affect an LCD, though.

The Future

Obviously, the largest drawback for flat-panel display technologies is the high cost. Although prices have fallen in the past couple of years, analysts say it probably will be at least a few years before plasma and large LCDs are considered anything but a luxury purchase. Once the flat-panel displays fall to the desired price point for consumers, however, growth should take off. Many analysts expect that magic price point to be \$1,000, which probably won't occur until early in the second half of this decade. **CPU**

by Kyle Schurman

For more on LCD and plasma screens, see www.cpumag.com/cpufeb03/displays.



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Growing Pains

How Windows & Linux Made It From The Cradle To Your PC

Spotlight Contents

OS Face-Off: page 56

Into The Great Unknown: page 63

Depending on which side of the operating system fence you prefer, you might compare the face-off between Linux and Windows as being analogous to either David vs. Goliath or the tortoise and the hare. Any way you slice it, both OSes can measure their popularity on consumers' PCs in billions of dollars and neither shows any sign of receding.

Both platforms claim humble origins, though, and neither seemed a sure bet when it first appeared. A quick stroll down Linux and Windows Memory Lanes offers some amusing, informative history. Who knows? Maybe there are even a few valuable lessons to pick up along the way.

Linux: The Power Of Free

Strictly speaking, Linux dates back to 1991 when Finnish programming whiz Linus Torvalds (now employed by Transmeta) started posting newsgroup messages and source code for his fledgling OS kernel. In reality, Linux's roots go back to 1971 when Bell Labs researchers created Unix. Throughout the '70s, Unix circulated through the computer departments at several universities and ultimately morphed into several versions, including Sun's Solaris and Berkeley's FreeBSD. However, the source code behind Unix was locked, preventing students from learning it, and corporate versions were priced well beyond the means of most individuals.

"In the early days of Unix," says Andy Nagle, director of SCO Linux products, "there were all these flavors, and nobody liked that, and that's partly responsible for helping Windows NT to be successful. But then all these graduate students, who were very capable programmers, wanted to be able to have a serious impact on commercial operating systems and were prevented because the Suns, HPs, and IBMs of the world didn't want any help. So the students made their own."

In 1984, Richard Stallman (www.stallman.org), formerly of MIT's Artificial Intelligence Lab, started work on the GNU OS, which was modeled on Unix but used entirely new source code

and operated under a free license agreement. Stallman, and those after him, worked to create the many building blocks and tools necessary in a complete platform, including a C compiler and (in 1999) the GNOME graphical interface, all of which was free. But by 1991, the GNU project was still years away from having a fully functional kernel.

During this time, Dutch computing professor Andrew Tanenbaum had constructed the MINIX OS, for which he made 12,000 lines of source code available in his book "Operating Systems: Design and Implementation." MINIX was designed to be an instructional tool, not a flexible, widespread OS. Still, programmers around the world studied MINIX, including an undergraduate student named Linus Torvalds.

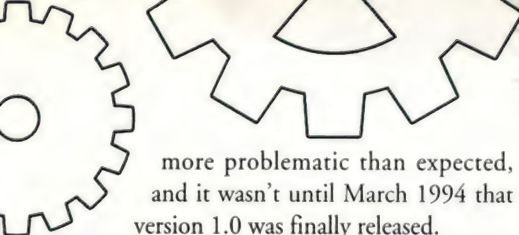
In 1991, Torvalds was 21 years old and confident he could improve on MINIX. In a famous Aug. 25 post to the MINIX newsgroup, which sported the subject line "What would you like to see most in minix?" he wrote:

Hello everybody out there using minix -

I'm doing a (free) operating system (just a hobby, won't be big and professional like gnu) for 386(486) AT clones. This has been brewing since april, and is starting to get ready. I'd like any feedback on things people like/dislike in minix. . . .

Version 0.01 appeared in mid-September. Feedback started cycling back to Torvalds, and over the next several months, the Linux kernel took shape. Support and enthusiasm for the free software continued to swell, although Tanenbaum posted a criticism at Torvalds, telling him, "Be thankful you are not my student. You would not get a high grade for such a design :-)"

By spring 1992, Linux enthusiasts successfully adapted the X-Windows system, giving the fledgling OS its first GUI. Torvalds was so pleased with the development that he renamed version 0.13 to 0.95, figuring Linux was about 95% toward reaching an official, networkable first release. However, networking proved



more problematic than expected, and it wasn't until March 1994 that version 1.0 was finally released.

From the mid-'90s, mainstream interest in Linux started escalating. In 1993, Linux boasted 100,000 users. Seeing the trend, organizations, such as Caldera (now the SCO Group), Debian, and Red Hat, soon adapted the Linux kernel with other applications and packaged them as distributions. Most were fee-based products aimed at corporations that lacked the resources or inclination to cobble together their own Linux solutions. Debian remains a free distribution built on a GNU/Linux distro containing more than 8,700 precompiled software packages. By early 1999, Linux users swelled to more than 15 million.

Today, Torvalds is the closest thing to a central Linux authority. It was he who officially released the 2.4 kernel in January 2001, for example. As the kernel evolves, the Linux community continues to update and improve the OS. When an authoritative decision is needed on the kernel's direction, Torvalds' opinion is still taken as gospel.

In his book "Just For Fun," Torvalds wrote, "There's no official version of Linux. There's my version and there's everybody else's version. The fact is, most people trust my version and rely on it as the de facto official version because they've seen me work for nine years on it. . . . But let's say I shave my head to display a 666 and say, 'Bow before me because if you don't I will smite thee!' They would just laugh in my face and say, 'OK, we'll just take this little kernel and do what we think is right.'"

A Victim Of Its Roots

Most, if not all, attempts to popularize Linux on the desktop have failed. Debian-based Corel Linux made a serious attempt in 2000 and bombed. Today, Lindows.com is taking a stab at the Microsoft masses, but the verdict on LindowsOS is still out.

"It's been said that the sincerest form of flattery is imitation, and the look and feel of Linux is very Unix-like," says Nagle. "They could've chosen to be Windows-like, and they did not because

Linux was done by a group of engineers primarily for engineers. Well, engineers like what Unix has to offer, so they built something that was familiar."

By the time KDE and GNOME developed to a point where the GUI coupled with Linux would have been comfortable for Windows users, a second impediment was firmly in place: Microsoft had done a tremendous job of addicting the world to MS Office, and Office wasn't going anywhere near Linux. Similarly, the host of other must-have applications and games were firmly entrenched in the Windows platform. Financially, there wasn't a strong enough demand on the desktop side for Linux, thus few large developers wrote applications for it.

"The lack of third-party applications is one of the major barriers to entry for any new OS," says David Adams, publisher of OS News. "The only reason that Linux was able to come on the scene is that there was this massive library of Unix software available to run on it. That's one of the reasons that Richard Stallman insists so vehemently that it should be called GNU/Linux. Without GNU and all the other Unix utilities and other software, Linux would not even be a footnote in computing history—just like without the ability to run DOS apps, Windows would have been a flop."

Slowly, application support is arriving. More Linux apps now support files for MS Office, Photoshop, and other must-have formats. It may be some time before we see a free Linux distro so easy and compatible that Windows is seriously challenged, but several fee-based versions are closing in. Similarly, according to Nagle, a completely free Linux is unlikely to take widespread root in the corporate world, if only because major vendors want a third-party distribution between themselves and their clients to guard against patent infringement. On top of this, there are a few substantial problems left for the Linux community to conquer, including compatibility.

"The only thing that really hurts the [Linux] desktop growing is the fact that the Linux kernel breaks compatibility with drivers in almost every minor version," says Eugenia Loli-Queru, editor in chief of OS News. "This is just death for

companies that want to keep their drivers closed (such as NVIDIA drivers, VMware drivers, and so on). Windows XP tries to have compatibility with Win9x drivers, even if that truly kills its stability. It is important to have binary compatibility with yourself. The Linux kernel hackers don't realize this because they see the whole thing from the engineering point of view, without seeing the big picture. This is one point where the Linux distros should step up and require binary compatibility at least for the minor versions of the kernel."

In a dozen years, Linux has traveled an amazing journey from an amorphous concept in an undergraduate's mind to a robust system capable of powering massively parallel NASA supercomputing projects. What will the next dozen years bring? See "Into The Great Unknown" on page 63 for some predictions.

Windows: Third Time's A Charm

Whether or not luck exists, the world favors those who are prepared to be lucky. Microsoft scored an unbelievable hit when it persuaded IBM to sign a contract letting Gates & Co., sell DOS to anyone while Big Blue couldn't. DOS put Microsoft at the center of the PC software map, but where could the company go from there? Microsoft was developing OS/2 with IBM, but IBM held all of the strings. Microsoft's first spreadsheet, Multiplan, had a three-month head start on Lotus 1-2-3, but was soundly trounced in the market nonetheless.

In September 1981, Microsoft saw the writing on the wall. Despite legions of devoted command prompt users, the GUI-based Xerox Star computer showed that the future could and probably would be graphical. Thus was born development on a Microsoft project called Interface Manager.

"Back at the time when Microsoft started looking at GUIs," says Michael Cherry, a 10-year Microsoft employee and Directions on Microsoft analyst, "the world was going to adopt some kind of graphical interface. But there were a lot of other technologies. Some were menu-based; some were graphical. Windows was

announced long before it was delivered, and there were people who felt that some of these competitors got waylaid because everybody was waiting to see what Microsoft produced. It's that 'fear, uncertainty, and doubt' factor."

In October 1983, VisiCorp released VisiOn, the first GUI for PCs. VisiOn featured cascading windows and a mouse pointer, but it also required a hard drive, which was still well beyond the mainstream then. IBM followed by announcing plans for its own GUI, TopView (not released until early 1985). Microsoft saw the industry passing it by and still had no product. So, Microsoft renamed Interface Manager as Windows and announced the product in November.

Things went from bad to worse in 1984 when IBM announced it would support VisiOn and release several apps for it. Gates countered that the forthcoming DOS 3.0 would contain a graphical environment, but it never did. Meanwhile, Quarterdeck released its GUI,

DESQ, and Digital Research delivered GEM, a PC interface so close to the Apple GUI that Apple threatened to sue Digital, which in turn pulled the product.

Finally, two years after its first announcement, Windows arrived to lackluster reviews and more threats by Apple. But Microsoft had something Digital didn't: Word and Excel for the Apple, two killer apps that helped spur Macintosh sales. Gates counter-threatened to kill off these titles, and the standoff lasted long enough for Windows to establish a bridgehead, even though sales were sluggish owing to a dearth of compatible applications. Perhaps the most critical thing Microsoft did to help build a future for Windows was court third-party developers.

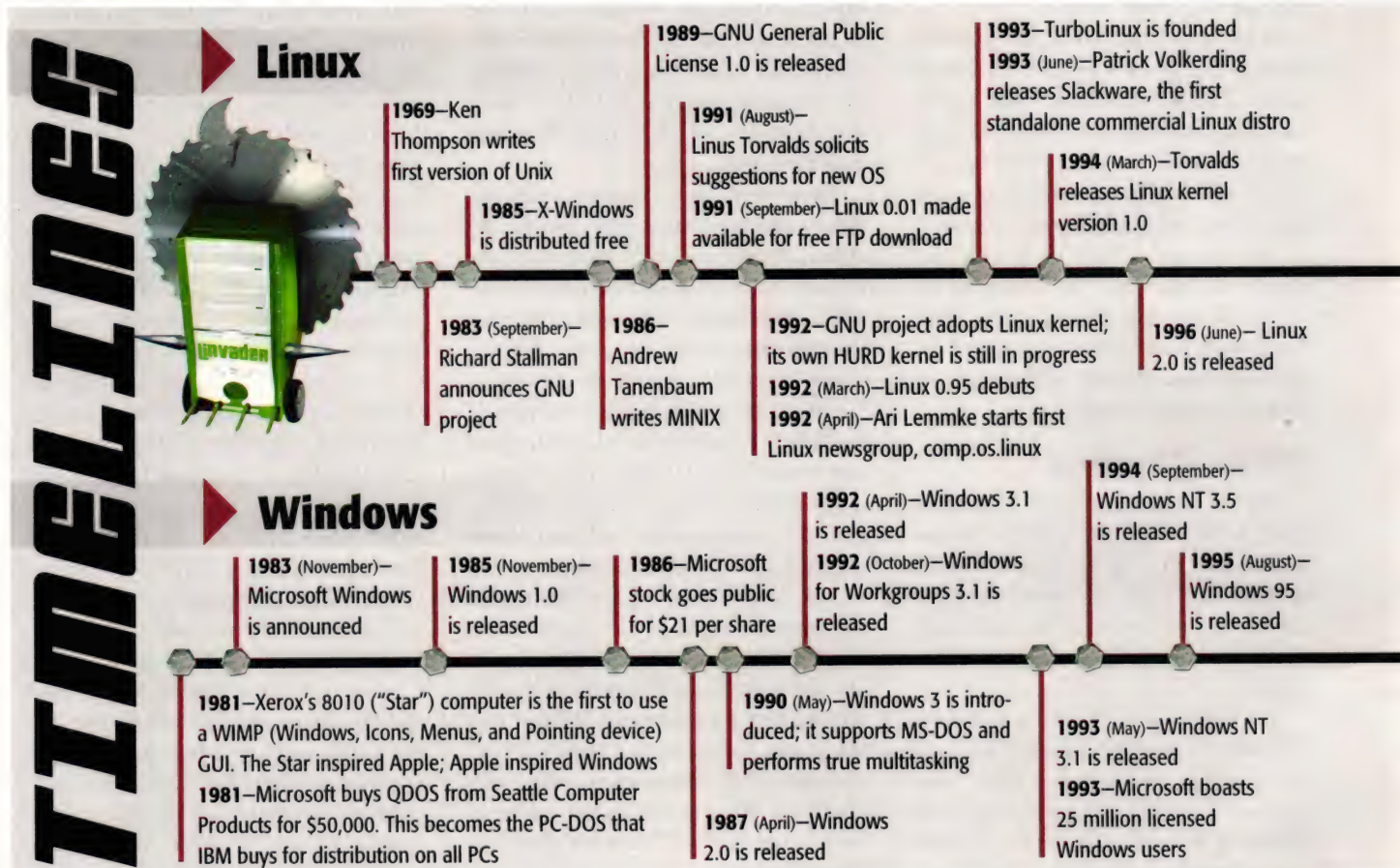
"Developers hated VisiOn because you had to pay an up-front fee to get the information you needed to write a program," says Cherry. "That's the same problem Apple suffers from. With Windows, you always got the software development kit. It

might have been hard to work with, but at least you got it."

In April 1987, Windows 2.0 arrived. Unlike the original version, 2.0 let users overlap windows, and icons debuted. Multiple DOS programs could run simultaneously. Major applications—Ami, Corel Draw, and PageMaker, not to mention Microsoft's own productivity apps—helped propel the OS further into the limelight.

In May 1990, Windows 3.0 arrived. Most experts consider it the first "true" Windows. Program Manager and File Manager thumped the relatively primitive MS-DOS Executive, and the icon-driven interface was far more intuitive. Windows 3.0 could finally address memory beyond 640KB, but the OS was notoriously unstable when multitasking. Two years later, Windows 3.1 fixed many of these problems.

In October 1992, Microsoft unveiled Windows for Workgroups 3.1, which integrated file and printer sharing into the



OS. These network features were buggy from the start, and it would be another year before Workgroups 3.11 remedied the situation.

Recall that Microsoft was IBM's development partner on OS/2. IBM's GUI was still a going concern, but when it came time to create version 3.0, Microsoft bailed and put its research into a wholly fresh platform called New Technology. In May 1993, Windows NT 3.1 (named to coordinate with the consumer Windows version) marked Microsoft's first stab at the corporate market. NT's kernel was far more stable, secure, and amenable to high-end programming. In September 1994, Microsoft split NT into Workstation and Server versions with the debut of version 3.5.

When Windows 95 arrived in the summer of 1995, Windows was unquestionably the de facto OS in home computing. The 32-bit system, with its overhauled Start button UI, proved immensely popular. Win95 integrated a TCP/IP stack and

dial-up networking to help users connect to the Internet. Even though MS-DOS (version 7.0) was still a part of the OS, Win95 was the first version not to require a separate, prior installation of DOS.

In November 1996, the first Windows CE-based devices appeared. CE bombed on its first two attempts. It wasn't until version 3.0 arrived in 2000—and a fleet of Pocket PC developers released their PDAs in 2002—that CE became a serious threat to Palm.

With Win95 and its two service release versions firmly entrenched, Windows 98 (June 1998 release) was a return to evolutionary rather than revolutionary OS updates. Win98 carried over the FAT32 and USB innovations from Win95 OSR2, then packaged in several Internet-age additions, such as Internet Explorer 4.0 and Active Desktop. However, anyone who owned OSR2 had to seriously question whether Win98 was worth the upgrade. A true upgrade in stability and functionality was going to require planting users on the

NT platform, and it grew clear that the consumer and corporate Windows lines needed to converge.

This convergence was supposed to take place with Windows 2000 (February 2000 release), previously called NT 5.0, but it didn't quite happen. Windows 2000 delivered a formidable set of new tools, including file encryption, VPN (virtual private networking), and Active Directory management. Because these features would only confuse most consumers, Microsoft pounded out one last version based on the antiquated DOS-based kernel: September 2000's Windows Millennium Edition. Apart from a handful of multimedia enhancements and a System Restore function, WinMe was short on valuable innovations, and the product was one of the least popular releases in nearly a decade.

In October 2001, Windows XP finally offered up the promised Windows family reunion. Distinct Home and Professional editions still sought to preserve some separation by only giving Professional features such as encryption, Remote Assistance, and System Restore, but the underlying architecture is identical for both programs.

Why Windows Won

Especially early on, Windows wasn't the best OS available, but Microsoft has always won out because of its superior marketing, nearly superhuman legal staff, and the ability to divine exactly what its target market wants.

"Whether or not Windows is great code from an engineering perspective, Microsoft knows just how good it has to be," says Cherry. "With each new version, you got enough features that people wanted and a quality that was good enough at a price they were willing to pay. That's why it sells. Look at XP. There weren't a lot of compelling features added, but the stability was much improved. But if you mess up any of those factors even a little bit, people won't buy it."

Once stability is settled, Microsoft has no choice but to add value through more features. Yet, how much more can

1998 (June)—KDE 1.0, the first full-blown Linux-compatible GUI, is released

1998 (June)—Torvalds appears on the cover of *Forbes*

2000 (March)—Ericsson announces the HS210, a Linux-based touch screen cell phone

2001 (January)—Linux kernel 2.4.0 is released

2001 (June)—Sharp announces the Linux-based Zaurus PDA

1999 (January)—Linux kernel 2.2.0 is released

1999 (January)—Samba 2.0's release lets Linux machines run on Windows networks

1999 (December)—VA Linux Systems goes public at \$30 per share, then skyrockets to \$300 per share

1997 (November)—Windows CE 2.0 is released

1999—
Windows 98SE is released

2000 (February)—Windows 2000 is released
2000 (July)—Windows Me is released

1998 (June)—Windows 98 is released

1996 (August)—Windows NT 4.0 is released

1996 (November)—Windows CE 1.0 is released

2001 (October)—Windows XP (Home and Professional) unites the consumer and corporate Windows families



Microsoft cram into Windows that XP doesn't already offer? Turn to page 63 for some possibilities.

On Down The Road

Where will Linux and Windows be 10 years hence? Microsoft's journey from ruling the desktop to ruling the enterprise was made easier because the interface was familiar to administrators, and those who knew desktop Windows could become Windows admins with relatively little effort. Linux may have started on AT machines, but it wound up flourishing on servers and, as noted earlier, previous attempts to translate the technology from admins to ordinary users have flopped.

Does this mean Linux can't thrive on the desktop? Perhaps.

"The GNU/Linux operating system was, is, and it will be for a long time an OS for geeks and power users," says Loli-Queru. "Until a (big) company takes the full responsibility for testing and developing most of the needed software, and maybe even offer up a lot of applications and create its own distinguished presence in the OS world (kind of like Apple did with FreeBSD, transforming it to the brand new platform of Mac OS X), I see absolutely no light at the end of the tunnel for Linux on the desktop."

Conversely, Lindows.com has proven that Linux and application installation can be vastly simpler (and cheaper) than Windows. Just as Microsoft had to spend years weaning its user base away from the command prompt, Linux is now struggling to appeal to average home users.

Microsoft has a history of overcoming any obstacle. Linux has a history of strong idealism, an ability to fill most any market niche, and a still-rising tide of popularity and household recognition. Which of these histories will translate into future dominance? Perhaps neither. If we can take away one lesson from Linux's development, it might be one about the necessity of community. It takes many to make a whole. There's room in the market for more than one OS. Perhaps if both sides can cooperate,

Mac OS: From 1 To X

The first Macintosh operating system, System 1, debuted with the original Mac in January 1984. The OS was derived from the preceding LisaDesk platform, only rendered less powerful for more stability. System 1 was only 216KB, and the use of folders was essentially a gimmick to help users because all files were written at the same level and identically named files weren't permitted. In April 1985, System 2.0 offered little more than some bug fixes, a Choose Printer dialog box, and better management of disk resources for Macs with no hard drives.

System 3.0 in January 1986 took a serious step forward with everything from heavy improvements—RAM cache for better performance, the new HFS (Hierarchical File System) file format, and laser printer support—to cosmetic jumps, such as zoom boxes and a bulging Trash Can.

In 1987, Systems 4 and 5 made few interface changes but brought the Mac into the world of color displays and multitasking. Hard drives were better supported and Multifinder let users juggle multiple apps at once. Interestingly, System 4.0 was only 260KB, but version 4.2 ballooned to more than 2MB.

The summer of 1988 brought System 6, complete with sound and graphics improvements and plenty of OS bugs. Nifty additions, such as a Cancel button and the Notification Monitor, gave users more control over system operations.

System 7 waited in the wings until May 1991 and was a significant overhaul of the Mac OS. To use the full features of OS 7, a hard drive and 2MB of RAM were necessary. But what features! Drag and drop, networking and file sharing, task switching, document linking, virtual memory, enhanced multimedia features, and (by

System 7.6 in early 1997) Internet functionality.

Later in 1997, System 8 showed off its Internet muscle with integrated tools from Netscape, Claris, and PointCast, plus an Apple-constructed Java virtual machine. The Internet setup was difficult, but the cutting-edge multimedia support ruled. Apple took a tip from Windows and added context-sensitive menus via Control-clicking. Although System 8 marked the end of 680x0 architectures, it was really more of a cosmetic update to System 7 than a fundamental OS improvement.

System 9 in October 1999 was a different story. The OS' biggest problem was incompatibility with some older apps, but what's a few upgrade licenses when you have an integrated search engine/shopping bot called Sherlock 2? There was multiple-user desktop support, login via voice recognition, and file encryption. Service Location Protocol support enabled Network Neighborhoods containing local and remote systems.

Many users opted to bypass System 9, though, and wait for the much-anticipated OS X, which was a massive departure for Apple. The OS is built on a Mach kernel running on BSD Unix, overlaid by Apple's luscious new Aqua interface. Version X (10.0) debuted in March 2001 with sweeping changes, such as pre-emptive multitasking, protected memory, and multiprocessing, but surprisingly little in the way of application support—or at least applications that could use X's innovations. Still, Apple has worked hard to refine X up to the present, and many early complaints have vanished. ▲



both can flourish side by side in the years to come.

For more information on the history of such "alternative" OSes as Amiga, Apple DOS 3.1, and others, read our "Dusting

Off The Antiques" sidebar at www.cpumag.com/cpufeb03/antiques. **COU**

by William Van Winkle

What
does your PC say
about YOU?



The United States Flag:
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Apple, Linux & Windows Strut Their Stuff

Sure, you have a favorite OS. But when was the last time you sat down to consider all your options and choose the best one for you? We've done the comparison legwork for you here, and now it's your turn to choose: Will it be Windows XP Pro, Apple Macintosh OS X 10.2.2, or SuSE Linux 8.1 Professional?

Our Methodology

We broke OS features into categories to compare and rate them. We primarily examined built-in features, although we also mentioned some features that you can enhance via third-party add-ons. Remember that this is strictly an OS comparison; there's no performance category in this article because that's largely a hardware issue. The only time we include hardware in the mix is for installation and driver issues to ensure that common peripherals are supported and can be installed without major headaches.

We assigned "grades" or scores on a standard A through F scale. No OS received any failing scores; an A doesn't mean that's the best OS for you. Picking a winner wasn't our goal. That will be your job the next time you consider an OS upgrade or a new computer.

Installation

We expect OS installation to self-configure the majority of its processes and require little input. We also want the installation process to bow to our every whim and provide advanced, custom, or manual control when and where we want it. The installer should detect any connected peripherals and correctly install the necessary drivers. Finally, the OS should recover from any errors that occur during installation, such as errors caused by power loss during installation or a user who resets the computer, thinking the installation is frozen because it isn't showing any overt signs of activity.

OS X and WinXP Pro did a good job of keeping us informed, while SuSE occasionally left us wondering how things were going. All OSes survived intentional power shutoffs and resets.

WinXP Pro and SuSE use a linear installation process, with all setup and installation occurring within a single installation program. (Actually, the installer calls different component install routines as the process advances, but to the end user, it appears as a unified installer.) OS X's installer assumes the hard drive has already been partitioned and formatted. OS X includes drive setup utilities, but you must run them separately from the installer.

All installations ran smoothly with the exception of SuSE, which had some problems when it attempted to check the computer's hardware and specify the settings that would be used during installation. Specifically, the SuSE installer occasionally displayed the software packages to install as "None." Running the installer again always corrected the problem, and installation then continued smoothly. On a positive note, YaST2 (the moniker of the SuSE install program) now supports dynamic resizing of

Windows partitions to create additional space for the SuSE OS.

All three OSes encourage you to register the software at some point during the installation process. In OS X, registration appears to be an integral part of the setup process, although it isn't. Only WinXP actually forces registration; if you fail to comply, it will downgrade some OS capabilities after 30 days.

OS X and SuSE correctly identified and installed appropriate drivers for the computer's hardware. WinXP Pro had trouble with a third-party FireWire card and couldn't locate a driver. It incorrectly created two entries for the card in the network adapter category. We corrected this easily after the initial install using the XP Device Manager. Once we removed the improperly configured card from the Device Manager, WinXP Pro redeemed itself and correctly identified and installed the appropriate drivers.

Once installed, all OSes ran smoothly. All provided methods for tweaking the OS configuration without rerunning the installer.

The bottom line. We were satisfied with all of the installation processes. All three OSes took the common installation environments in stride, particularly OS X. We like the SuSE installer's

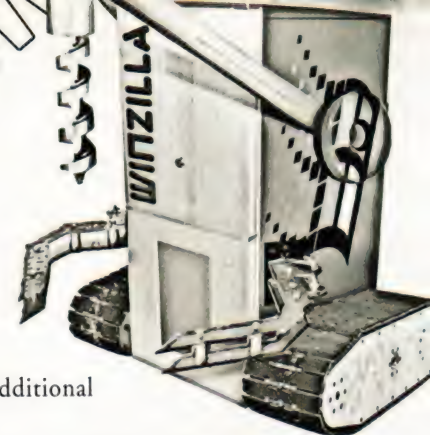
ability to perform simple or very complex installations, although we had to knock it down a grade for incorrectly identifying the necessary software packages to install.



Driver Availability & Installation

No computer is an island unto itself. Most are connected to at least a couple of devices, either internally or externally. We prefer to see a gaggle of drivers included with an OS, but drivers available from third parties are also acceptable.

We were pleasantly surprised by SuSE. Between the drivers included with the installation process and the support of manufacturers and open-source developers, we were able to find usable drivers for all our hardware. WinXP Pro and OS X have problems with third-party drivers for such devices as printers, scanners, and digital cameras. Generic drivers allow most devices to work but with limited functions. For example, a generic printer driver allows printing but not the ability to select tray options or other print handling capabilities. On the bright side, most manufacturers promise native driver support in the near future. We didn't feel any OS was unduly shackled by a lack of drivers.





When it comes to installing the drivers, SuSE, like any Linux system, may require you to recompile the Linux kernel to get your hardware working. Many currently available drivers must be compiled on your system before you can use them. Although recompiling the kernel or compiling drivers isn't difficult, it can be an interesting experience if you haven't done it before. And we don't mean "interesting" in a good way. You'll likely tear out more than a few hairs as you try to figure out why you're generating so many errors during the compile and what you're supposed to do to fix them.

OS X doesn't suffer from this problem. Although both SuSE and OS X are based on Unix variants, OS X's kernel architecture lets drivers run outside the kernel space. No recompiles are needed, and because OS X only runs on Apple hardware, it's not necessary to compile drivers before using them.

WinXP Pro and OS X have simpler models than SuSE for installing drivers. Neither requires you to fiddle with its respective kernels; both have simple installation systems for adding drivers. Both can detect new hardware configurations and prompt you for any necessary drivers. WinXP Pro offers very good driver management, both in the ability to enable or disable devices and their associated drivers, and in the ability to "roll back" to previous versions if a new driver presents unanticipated problems.

The bottom line. Even with some drivers currently unavailable for OS X and WinXP Pro, we thought the trouble with driver installation in SuSE outweighed its advantage of greater driver availability. All OSes lost points in this category.

User Interface

User interface is perhaps the most subjective of our categories. What one person considers a well-designed feature, another considers a point of contention. We focused

on the GUI, although all three OSes provide a command line interface of some type, ranging from WinXP Pro's DOS prompt to OS X's terminal, which runs the tcsh shell by default, and SuSE's shell or KDE Konsole, both of which use bash as the default shell. You can configure both OS X and SuSE for multiple shell types.

WinXP Pro's GUI goes by the handle of Luna, while OS X's user interface is known as Aqua. Despite catchy names, neither can hold a candle to the sheer number of GUIs available for SuSE/Linux: 11 that we know of, and no doubt there are others we haven't stumbled across yet. SuSE ships with both KDE and Gnome as available GUIs. KDE 3.0 is the default installation and the one we used for our testing.

When it comes to user interface, nothing seems more polished than Aqua; it's simply stunning. There's no shortage of eye candy, but there's also substantial usability. The most noticeable may be the quality of on-screen text. Thanks to the Quartz rendering engine, text is rendered smooth with anti-aliasing technology, making it easy on the eyes. OS X takes this a step further, using subpixel rendering to produce sharp text even on LCD screens. Icons also have a high-resolution look, well beyond what you'd expect from a GUI. This is also due to the Quartz engine's rendering technology and allows scalable icons of nearly any size.

WinXP Pro offers two user interface options: Luna, the default, and Classic, the older Win2000 interface. Luna delivers attractive screen text, using Clear Text technology for anti-aliased text. Surprisingly, this capability is turned off by default. Once you turn it on (in the Appearance tab of the Display Properties Control Panel), Clear Text smoothes the edges of screen fonts for crisp display. Luna also provides many customization possibilities, including themes. WinXP's default theme is bold, with heavily saturated colors framing windows. Icons are available in two sizes, with none of the scalable capabilities found in OS X.

SuSE uses KDE 3 with a few enhancements tossed in, including a collection of GUI tools to configure

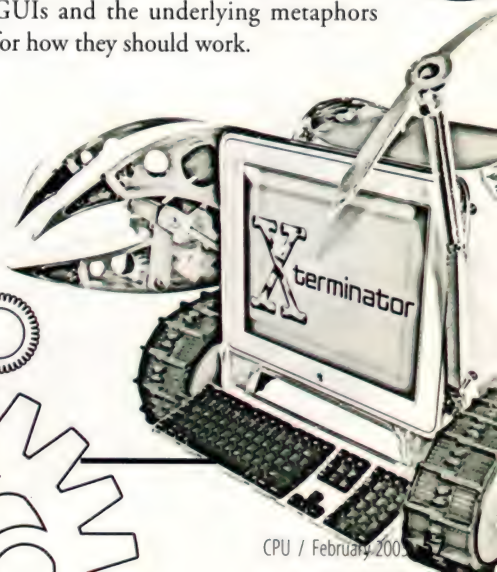
the desktop the way you want it. Scalable TrueType fonts, anti-aliasing, and subpixel rendering deliver pleasing rendering of text, once the Achilles heel of Linux GUIs. You can create up to 16 desktops, each with its own applications and open windows, and easily switch among them. One could run the Web browser with your favorite Internet tools open, and you could configure another for your word processor, grammar checker, and spelling tools. You can also be conventional and use a single desktop, with multiple applications running.

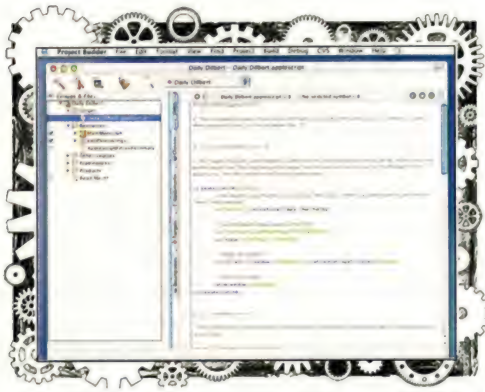
The bottom line. OS X has the best-looking GUI; WinXP Pro and KDE are the best for customization. Overall, KDE and OS X edged out WinXP Pro. The Luna interface draws too much attention to itself, with deeply saturated colors and large frames for windows that together overpower the content. All user interfaces have some inconsistencies or difficulties that need work.



Ease of Use

Ease of use can largely be defined by what you're used to. In that respect, advocates of each OS will point to theirs as the easiest to use. In normal daily use, all OSes performed well, in large part due to the GUIs and the underlying metaphors for how they should work.





AppleScript, a scripting language for automating processes, is one of OS X's many strengths. AppleScript Studio is included with OS X to aid in developing and debugging AppleScripts.

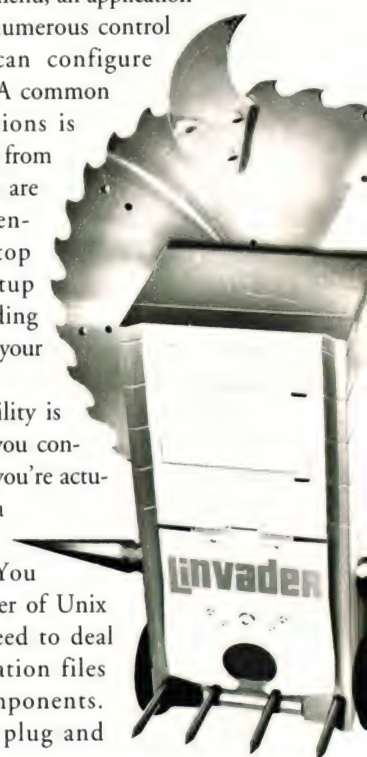
WinXP Pro's Luna interface presents a new focus for Windows, dominated by the idea that the task is the driving force, not the application being used to complete the task. The task-centric concept isn't new, but Luna takes it to new heights. Whether that's good or bad depends on whether you're a new or experienced user. For new users, the task orientation can be helpful, but for experienced users, it can be frustrating. For example, to change screen resolutions,

you go to the Start menu and select Control Panel. The Control Panel window displays the various categories of things you can do your computer, in this case, change its appearance. In the Appearance and Themes window, there's a list of tasks that can be performed, including changing screen resolution. Once you select this option, you're presented with an old favorite, the Display Properties control panel. Luna's task-based process stepped you through three windows to get to a control panel that's only a click away in the Classic GUI, running counter to the idea of making things easier to use.

Luna also modifies the Start menu, creating a bloated display that can take up a third of your screen width, without cascading menus. The new Start menu puts a list of recently used applications on the first level, rearranging the order each time you use an application. This method keeps you guessing, because you never know where the application you want will be listed. Fortunately, WinXP Pro is gracious enough to let you change the GUI back to the older Win2000 interface.

SuSE's KDE 3 provides a well-organized Desktop interface that's remarkably similar in concept to the classic Windows interface. There's the K menu, much like the Windows Start menu, an application launcher, and numerous control panels users can configure as they see fit. A common set of applications is readily available from the Desktop, as are the most-often-needed Desktop and Linux setup utilities for adding to or modifying your Linux system.

OS X's usability is amazing when you consider that what you're actually running is a BSD-based Unix system. You get all the power of Unix without the need to deal with configuration files or adding components. Everything is plug and



MS WinXP Pro

Pros

- Runs on a wide range of hardware
- Windows has the largest market share in desktop computing.
- Large selection of applications and utilities
- Faster hardware, especially with 3D graphics cards

Cons

- Major security problems
- Lack of robust server offerings
- No development tools included
- Have to reboot every time you change your network configuration



SuSE Linux 8.1 Professional

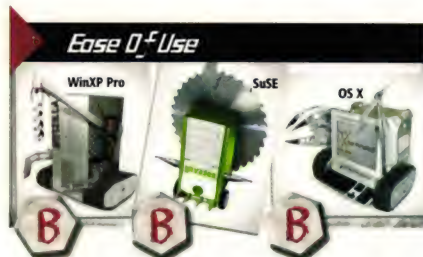
Pros

- Runs on a wide range of hardware, including older hardware
- Largest number of available user interfaces
- Largest number of supported file systems
- Includes journaling file systems
- Can be used as a server or desktop OS
- Stability
- Security
- Includes multiple development environments
- Large selection of applications and utilities available via open source

Cons

- Updating drivers may require a kernel recompile
- Limited support for games
- Support for accelerated 3D graphics cards limited to beta drivers
- Limited commercial applications for the desktop
- Linux can be difficult to learn, particularly for newer computer users.





play, in the truest sense. But not everything is rosy. The Dock, which replaces the old Apple menu, is the best or worst change, depending on your personal take. The Dock works well, but it lacks the ability to organize applications or files in a cohesive manner. You can add applications and move them around to reorder them, but you can't mix applications and their related documents, nor can you easily create folders of related applications, such as putting all the applications you use for Web design in a single pop-up menu tied to the Dock. This type of organization was easy with Apple's older OS 9.x system. Despite that

Mac OS X 10.2.2

Pros

- Easy to install
- Leader in user interface design
- Security
- Stability
- Multimedia-savvy
- Includes journaling file systems
- Includes development and scripting tools
- Can be used as a server or desktop OS

Cons

- Computers only available from Apple
- Base hardware is more expensive than other platforms.
- Few system and disk utilities available
- Fewer games available than for Windows
- Hardware drivers may be lacking until new OS X drivers are released.



failing, organization is the key to how well OS X works. The freewheeling file structure available with Apple's older systems is replaced with the draconian hierarchy that the Unix underpinnings crave.

WinXP Pro and SuSE include utilities to track application installations and remove them at will. OS X foregoes this method. Instead, it requires an application to store all its files within the application folder. This permits easy removal and also lets you drag an application to a new location within your file system without wreaking havoc on its usability. This prevents the seemingly random spewing of files that many installers seem to take great glee in, but enough file residue lurks around to convince us that an uninstaller would be an asset for OS X.

The bottom line. All three OSes offer robust operations. All provide protected memory systems in one form or another; during our testing, no system crashes occurred with any OS. All three OSes have a well-deserved reputation for being more stable and secure than earlier versions.

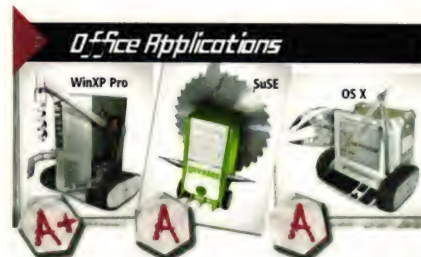
When configured in its Classic environment, WinXP Pro's ease of use is on par with the others. But Luna needs additional refinement before it can serve as a mainstream interface for power users. OS X is very usable but lacking in customization capabilities, as well as an uninstaller. SuSE's KDE interface has some rough edges, but nothing that jumps out at you and says it's a problem.

Showing Off

Now that we've covered the subjective issues, let's look at the overall capabilities of each OS, as well as the availability of third-party applications and utilities.

Office applications.

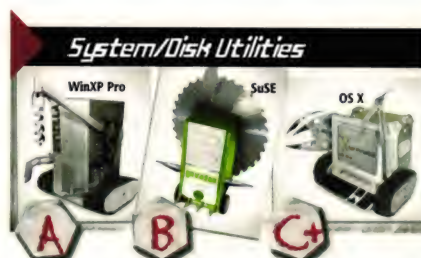
All three OSes excel in the office productivity category. None lag behind when it comes to word processors, spreadsheets, database systems, and presentation programs. Many



applications are cross-platform. This category is nearly a tie, but we gave bonus points to WinXP Pro because there are more choices available.

System/disk utilities. Power users demand utilities for tuning, tweaking, maintaining, and repairing an OS and its file system. OS X currently has the fewest available products, although all the basic needs are covered, including drive repair, defragmentation, and optimization. Plenty of drive repair and performance utilities are available for SuSE, but for sheer number, WinXP Pro can't be beat.

The same ratio applies to most system utilities. OS X covers all the basic needs but with the fewest choices. SuSE has more choices, and WinXP Pro has the most. Of course, quantity and quality are distant cousins, but if you like lots of choices, WinXP Pro is the way to go.



Games. When it comes to games, OS X and SuSE can't touch WinXP Pro, in quality or quantity. The explanation for this lopsided ratio has to do with both the obvious reasons (Windows claims more users than any other OS), and the technological ones (the Windows platform has some of the best-performing graphics cards for gaming available). Interestingly, Microsoft doesn't support OpenGL, a common form of graphics acceleration many games use, but graphics card manufacturers usually do, so OpenGL support is attainable from the manufacturers' drivers.

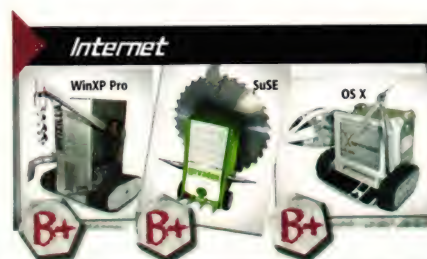


OpenGL support is built into OS X for 3D acceleration. SuSE currently can't support any graphics card's hardware-based acceleration, although there are beta drivers available to enable acceleration. We enabled the beta drivers for our graphics card, an early ATI RADEON. We haven't experienced any significant problems during normal use, but we also haven't seen any advantage when running games under SuSE.

Apple has been trying to gain mind share with game developers with OS X, and it seems to be working: There's a constant stream of new game announcements. Games optimized for OS X and WinXP Pro play equally well. WinXP Pro may have a slight edge; with the right hardware, WinXP Pro can deliver faster frame rates than OS X. Any advantage in actual game play seems negligible, however.

Internet. All OSes installed and correctly configured the necessary protocols for Internet access. If you need to make any changes, WinXP Pro usually requires rebooting, while OS X and SuSE do not. The requirement to reboot for networking changes to take effect is a limitation of the NT kernel that XP is based on.

Once connected, all OSes provide the expected tools, including Web browsers, FTP services, and Internet tools (such as ping, traceroute, NS Lookup, and Finger). OS X wraps these Internet utilities in a single GUI for ease of use, while SuSE and WinXP Pro make them available from the command line/console.



WinXP Pro's use of Internet Explorer as the default browser provides fast and compatible browsing. The OS X version of IE is slow and exhibits many quirks. SuSE comes equipped with the Konqueror Web browser, which loads pages as fast as IE and has good compatibility with Web technologies, although displayed text can be hard on the eyes, regardless of font size. All of the OSes can use alternate browsers, which may be a better choice, especially if you want more control, such as the ability to prevent pop-up ads.



SuSE summarizes the settings the installer will use. We occasionally had problems with the Software category, with software packages displayed as "None." A reinstall did the trick.

We deducted a bit for each OS: WinXP Pro for the need to reboot to make changes; OS X for slow Web page loading; and SuSE for marginal text in the default browser. We did, however, like the wide range of Internet utilities available for each OS, either included or from third parties.

Networking. All of the OSes support a wide range of network protocols, with SuSE supporting the most. OS X 10.2 introduced a new self-configuring protocol, called Rendezvous, based on the ZeroConfiguration (zeroconf) workgroup of the Internet Engineering Task Force (www.ietf.org). The idea is for Rendezvous to automatically configure IP interfaces, perform automatic host-name-to-IP translations, discover what services are available on a network, and perform IP multicast allocation. WinXP Pro is moving toward the idea of zero configuration.



Microsoft's first attempt, called Wireless Zero Configuration, is geared directly toward wireless communication and makes it easy to add wireless equipment and services to a network. SuSE currently has no automatic (serverless-based) utilities to automate the setup of networking protocols and services, but it can connect to almost any type of network.

OS X is very versatile when it comes to connecting to Windows networks. With support for SMB, Windows' native file sharing system, OS X can easily access Windows shares. WinXP Pro includes networking wizards to assist in setting up a home network and can even create a floppy with all of the network information, which you can take from computer to computer to assist in setup.

One surprising area where WinXP Pro leads the pack is in support for IP over FireWire, which allows FireWire to be used for networking. This is surprising because Apple has been the champion of FireWire technology and its many uses. In the final analysis, all three OSes perform on equal footing in networking.

Security. All of the OSes have security-related issues. Windows OSes tend to have all services and ports open and ready for use; in contrast, OS X and SuSE tend to have all services and ports disabled by default, requiring users to turn on a service when it's needed, a much more secure model. Microsoft is making progress in reducing the number of vulnerabilities, as well as responding in a timely manner with necessary patches.



Marketing Battle Lines Have Been Drawn

There has been much speculation lately about whether Windows can maintain its position as the dominant OS. Open-source software is making inroads into the corporate market, and where the corporate back office goes, so goes the desktop. Meanwhile, Apple continues to court its traditional markets, publishing and education, while making inroads into media production, gaming, and the server market. To read more about this power struggle, see the rest of this sidebar at www.cpumag.com/cpufeb03/marketbattle. ▲

All three OSes include firewall capabilities. OS X and SuSE offer a GUI interface as well as a command line interface for their firewalls. In both OSes, the GUI is limited in configuring the firewall, although more capabilities are available via the command line.

All three OSes are multiuser systems, requiring additional security to keep private information between users private. All provide the standard password-protected user accounts, group policies, file system encryption, and access and use policies. None has an overall interface for setting up and maintaining security policies. Instead, these options are divvied up among multiple utilities, making policy management more difficult than it needs to be. SuSE provides the most options for security settings, including the ability to specify the encryption used for passwords. OS X's interface for setting up groups and use policies is the NetInfo Manager, a holdover from the Next OS. Although serviceable, it's poorly documented.

SuSE and OS X currently have the best security records. WinXP Pro needs more work and different policies before it can become a trusted computer system.

Programming. OS X and SuSE include development tools, on CD and/or from the manufacturer's Web site. Both OSes offer a number of supported development

environments. OS X includes an IDE for developing in C, C++, Object C, and Java, as well as an Interface Builder for creating the necessary user interface elements. SuSE includes support for C, C++, and Java, with additional development tools



WinXP's Luna Start Menu can claim more than a third of your screen real estate.

available. WinXP Pro has no included development tools, although plenty of development tools are available from Microsoft. Third-party development tools are available for all three OSes, so finding what you need shouldn't be a problem.

When it comes to scripting environments, OS X leads the way, with support for Ruby, AppleScript, Perl, PHP, Python, Tel, Javascript, and more. WinXP Pro includes support for VBScript and JavaScript, while SuSE comes with PHP, Perl, JavaScript, and shell scripting. Additional scripting languages for all three OSes are available from third parties.

OS X gets a few extra points (but not enough to bump it above an A) because many of the development tools can create programs for earlier Mac OSes, plus

Windows and various flavors of Unix/Linux. Microsoft dominates the development tools market for WinXP Pro, although there are other suppliers. SuSE can use any development tools available for Linux systems.

Multimedia. Each OS supports the most popular multimedia features, including music and video. In some cases, it's difficult to decide whether a feature is a strength or a weakness. Take WinXP Pro and Windows Media Player, for example. Windows Media Player includes digital rights management features; in essence, it can prevent you from duplicating multimedia files or using them on devices or applications independent of their original location. Is this feature a strength? It's anticipated that many music labels will support music downloads in Windows Media Player format because they're reasonably assured pirating will be difficult, if not impossible, which should result in a greater selection of content. Or is this feature a weakness? Windows Media Player may not let you exercise your fair use rights and create copies of music for use in more than one player.

Setting aside issues of digital rights management, all three OSes offer satisfactory multimedia capabilities. All support DVD playback, MP3 players, and audio ripping. OS X and WinXP Pro include applications for movie editing, although OS X's iDVD and iMovie are currently more full-featured than their WinXP Pro counterpart. SuSE doesn't ship with any movie- or DVD-editing tools, but some third-party tools are available. All of the OSes support CD-ROM burning, as well as CD-RWs. The ability to burn in DVD+R and DVD+RW formats is available from third parties, although Microsoft plans to support these formats directly soon.



All three OSes support digital cameras and scanners. OS X and WinXP Pro include tools to automatically download and catalog pictures from a digital camera.

Each of these OSes support many multimedia file formats, as well as plenty of tools to manipulate them. OS X is in the lead with its built-in collection of multimedia software. WinXP Pro comes close, with similar tools in almost every category, although most don't offer the same ease of use or feature sets. We expect that to improve because both Apple and Microsoft see multimedia as a big selling point. SuSE has the basics covered with the included tools in the KDE interface but lacks tools for video/DVD authoring.

Mobile Computing. All three of these OSes include power management capabilities. SuSE uses the KDE Desktop interface, a power management system that can monitor battery life, extend battery life through standby and suspend modes, and provide low battery warnings. WinXP Pro also offers a full suite of power management capabilities for road warriors. The power options let you turn the monitor off after a set time period of no activity; spin down the hard drive; put the system into standby, which uses minimal power; or hibernate, which uses even less power but requires a longer period of time to reawaken than standby does. OS X uses the Energy Saver application to monitor battery usage. It displays estimated remaining battery life, can turn off the monitor, power down the hard drive, and put the computer to sleep to conserve power. OS X also supports deep sleep, which further reduces power consumption.

WinXP Pro and OS X also support PDA syncing. OS X includes the iSync application for keeping your calendar and contact information synchronized with Bluetooth-enabled phones, iPods, Palm OS devices, and multiple Macs. WinXP Pro

provides the handy Briefcase for syncing files between PCs, as well as a Synchronize Manager for keeping files synced at scheduled times or when network drives are available. Manual syncing is also supported. You can use all three OSes with Palm OS-based PDAs. Pocket PCs still sync best with WinXP Pro, but third-party tools are available for syncing with OS X and SuSE.

Services. You can use all three OSes as Web servers, mail servers, file servers, and FTP servers. WinXP Pro uses its IIS products to provide Web server and FTP services but is limited to a single Web site and 10 simultaneous client connections. The IIS package included with WinXP Pro is designed more for personal use than for serving business Web sites. OS X and SuSE both use Apache as their Web server, and they don't have the same restrictions as WinXP Pro. On the other hand, neither



OS X nor SuSE has a GUI for administering your Web server, although OS X has a GUI for starting and stopping the services. OS X and SuSE include DNS service using Bind. WinXP Pro's limited implementation of IIS is disappointing, especially compared to what used to be available in previous versions of Win2000 and WinNT.

For Further Consideration

Here are a couple points that don't really lend themselves to grading but are still important to consider.

Support. WinXP Pro comes with two free incidents and unlimited installation support. Additional support is available at \$35 per incident. OS X provides 90 days of phone support. You can get additional support through the AppleCare program, which provides three years of support for \$169 to \$349, depending on the product. Prices include hardware repair and replacement services in addition to basic phone

support. SuSE provides free installation support via email or phone for the first 60/90 days. Support for noninstallation issues is charged on a per-incident basis of \$39, which covers 20 minutes of live support.

In addition to paid support services, all of the manufacturers provide free support via their Web sites. All offer a searchable database of known issues, how-to articles, and hardware compatibility databases.

Price for performance. SuSE (\$79.95) and OS X (\$129) pack the best price-to-performance ratio. It's really a matter of which interface you prefer.

SuSE packs all the tools and basic software the desktop user needs, as well as a GUI. It's also powerful enough to be used in a server or development environment. The only serious deficit for the desktop user is the need to recompile the kernel whenever you install drivers. We believe this limitation is key to preventing wide-scale use of Linux in the desktop environment.

OS X features a GUI that can completely conceal the underlying BSD Unix OS for casual users, while at the same time provide a rich set of tools and options that power users and Unix geeks would love to have at their fingertips. Like SuSE, OS X includes a wide selection of development tools.

WinXP Pro (\$299; \$199 upgrade) is significantly more expensive than the competition. It provides stability, but so do its competitors. Its ability to be used in a server environment is limited. With the exception of VBScript support, WinXP Pro requires third-party tools for any advanced development work. It's overpriced for the features it offers, particularly when compared to SuSE and OS X.

You Be The Judge

A wise man once said, "Never get involved in a land war in Asia." Equally sound advice would be, "Never get involved in a war between operating systems." OS wars could continue to the end of time and beyond, with none of the sides ceding any territory. When all is said and done, only you can decide which OS is best for you. **CPU**

by Tom Nelson and Mary O'Connor



Into The Great Unknown

An Exploration Into The Future Of Today's OSes

What does the future hold for the operating systems that you love—and the ones you love to hate? We looked into our crystal ball and took a trip to the rumor mill to glean what's in store for Windows, Linux, and Mac OS. What we found is intriguing, but remember that the operating systems of the future are still being designed, so these predictions should be taken with a grain of salt. Make that a big scoop of salt. Until these OSes are officially released, anything could happen.

Linux

There's some debate whether the new Linux kernel will be called version 2.6 or 3.0, but there's no argument that by either name, the next kernel upgrade will be packed with new features. Users will appreciate support for more devices, including USB 2.0, AGP 3.0 video cards, PC Cards, and Zoom video.

A feature called User-mode Linux will let you run Linux under Linux, VMware-style, making processes invisible to others. If you do a lot of beta testing or product reviews, User-mode Linux can keep your main system safe from misbehaving software. It can also mean improved security, as you can run a server in User-mode Linux, preventing anyone who breaks in from getting to your main system.

The new version will support more filesystems, including compressed, JFS, zerocopy NFS, and read-only ones (squashfs, cramfs, and perhaps ramfs and libfs). LVM2 and EVMS will provide storage management. The SCSI subsystem will see improvements, and the IDE/ATAPI CD-ROM subsystem will no longer need to emulate SCSI hardware for the purposes of writing to CDs. Packet writing

will allow for burning CDs in bits and pieces. There will be improvements to the virtual memory system and console/TTY subsystem. Look for plenty of features for developers and kernel hackers, too. The Linux Trace Toolkit will let programmers trace what the kernel is doing step-by-step as it interacts with their code.

Thread-aware core dumps will also make debugging easier. When the kernel or a Linux app has a massive failure, it "dumps core," saving everything in its memory into a huge file. Thread-aware core dumps let programmers narrow down what's happening in each individual thread. A new kernel configurator, kconfig, will make it possible to reconfigure a kernel before utilizing a GUI interface that's more flexible than the old console configuration routines. Thanks to a multipane GUI, kernel hackers will be able to see help data by clicking an option rather than opening new windows.

There isn't an official release date for the new kernel, but Linus Torvalds has said possibly around June. You can take your chances with the new kernel's beta via download at www.kernel.org.

Dig Deeper

Want more insider information, rumors, and fanatical speculation about your favorite operating system? Here are a few sites to check out:

Linux:

- Kernel Traffic mailing list; kt.zork.net/kernel-traffic
- The Linux Kernel Archives; www.kernel.org
- LWN.net; www.lwn.net

Mac OS:

- Mac OS Rumors; www.macosrumors.com
- SpyMac; www.spymac.com
- Think Secret; www.thinksecret.com

Windows:

- Paul Thurrott's SuperSite for Windows; www.winsupersite.com
- NeoWin.net; www.neowin.net
- WinBeta; www.winbeta.org

General:

- BetaNews; www.betanews.com
- OSNews; www.osnews.com
- Slashdot; www.slashdot.org

Of the three major operating systems, the future of Mac OS X is probably shrouded with the greatest mystery. Apple refuses to comment about upcoming OS releases, and the Mac rumor sites have precious little information about future versions of OS X. That's just how Apple wants it.

"Apple is incredibly militant about information leaks these days, to the point of keeping most secrets from other parts of the company. If the wrong thing gets out, it's a firing offense," says Adam Engst, publisher of the Mac newsletter TidBITS (www.tidbits.com).

Here's what is known: Version 10.3 is code-named Panther, continuing in Apple's tradition of feline-related names for OS X. (Version 10 was Cheetah, 10.1 was Puma, 10.2 was Jaguar, and 10.2 Server was Tiger.) Panther is expected to ship sometime this year, perhaps around July.

A change to new Apple computers sold this year prevents them from booting directly into OS 9, dubbed Classic. But it is rumored that there is improved support for running Classic applications within Panther, with better access to peripherals and a seamless interface that is more consistent with OS X's Aqua look. It's expected that an OS X preferences panel dedicated to Classic controls will eliminate and replace Classic's menu bar and control panels.

Insiders expect that Panther will include low-level performance optimizations that should speed up all applications. Pre-emptive multithreading is expected to be more widely used in the Finder. Installing hardware drivers could also become easier, as Panther's software update system may be expanded to download and install drivers for more third-party USB and FireWire peripherals.

Panther may also bring a new application: a free version of the AppleWorks word processor that's compatible with Microsoft Office files. Although the program may be included with Panther, a subscription to Apple's .Mac service may enable extra features.

Low-level security features are planned to keep viruses and other nastiness at bay. Any suspicious activity in server processes, BSD processes, and kernel extensions will be suspended and reported to the user, who will be able to kill or resume the suspect process.

More wild-eyed predictions say that Panther may support 64-bit processors or even run on x86 systems, and that it may improve support for clustering, or using several computers together for one task. These features may indeed be coming, but probably not as part of Panther.

Many users expect future OS X releases to be evolutionary, as the relatively young operating system matures. "Apple just had their revolution, and it's going to take 150% of their available resources to actually carry it through to success. I think that their biggest problems are going to be actually arriving at square one," says David Adams, publisher of the OSNews Web site (www.osnews.com). "I personally think that Apple's next revolution will be one they take on quite unwillingly: finding a new processor to build their next generation of computers with. Depending on their choice—Intel, for example—it could take a huge engineering effort to pull it off."

The future of Windows is somewhat less mysterious, as leaks, rumors, and screen shots of Microsoft's nascent operating systems are plentiful. Three Windows operating systems may be coming to a PC near you in the middle future: Windows XP Second Edition; followed by Longhorn, the next major upgrade to the desktop OS; and Blackcomb, the next server OS.

The first out of the gate would probably be Windows XP Second Edition, which, if it exists, could ship late this year. Rumormongers expect that XP SE will be a fee-based upgrade that could include Internet Explorer 7 and DirectX 9, plus perhaps a few features from Longhorn that are ready early. But Microsoft has denied that there will be an XP Second Edition at all.

Most of the buzz concerning the future surrounds Longhorn, which Microsoft has called the next major version of Windows. Longhorn is expected to feature interface changes, a powerful new file system, and support for Palladium "trusted computing" security technology. Longhorn is also expected to include built-in DVD burning tools. Currently in early alpha testing, Longhorn won't ship until late 2004 or in 2005.

The future OS' interface tweaks are expected to include a new visual style, dubbed "Plex," and the addition of the Sidebar, a customizable, XML-based dock. The Sidebar is built from movable "tiles" that can fetch information from the PC or the Internet. A new 3D system is anticipated to further change the system's look, allowing for full-motion video from the Windows interface. Screen shots of Longhorn from an early alpha release resemble WinXP with new technologies grafted on. Both the interface and infrastructure are likely to undergo major changes before the official release.

WinFS (Windows Future Storage) is the name of the new file system, built on a SQL database. WinFS will provide new ways to sort and search information and allow for a new "preview view" that serves up detailed information about files.

"It seems that most of Microsoft's efforts will continue to go to leveraging its OS dominance to establish lucrative footholds in other markets, like Web services," says Adams.

In the realm of server OSes, Microsoft is expected to release Windows .NET Server 2003, its follow up to Windows 2000, in April. There will be four versions including Datacenter for mission-critical corporate servers and a version dedicated to low-end Web servers.

Looking further into the future: Blackcomb, the codename for the next major Windows server release, isn't expected until after Longhorn ships, perhaps as late as 2006. Microsoft has scrapped plans to release a server version of Longhorn. **CPU**

by Kevin Savetz

stretch your imagination



The CRW-F1 With Exclusive DiscT@2 Technology

The **Ultimate** CD Recorder

Yamaha's all new CRW-F1 is designed to enhance the style of the contemporary computer workstation. Engineered for easy connectivity via ATAPI, FireWire, USB 2.0 and SCSI, the CRW-F1 delivers reliable performance, high quality and top speed CD recording with whisper quiet operation.

Among its long list of impressive new features, CRW-F1's revolutionary DiscT@2™ Laser Labeling System stands out as the world's only laser based "tattoo" system to etch graphics and text onto CD-R discs, eliminating the need for labels. Next, enter the exclusive new Advanced Audio Master

Quality Recording System and hear Yamaha's studio quality advantage in your own living room. Add in the industry first Ultra Speed ReWrite, the triple-guarded SafeBurn multitasking technology and the exclusive live recording mode, and you will discover why critics herald the new CRW-F1 as the *most complete* CD Recorder in the World!

So, whether you are a PC user or Mac user, let Yamaha CRW-F1's extraordinary features and technologies take you to a world with infinite possibilities and where stretching your imagination is just the beginning...



YAMAHA

The Bleeding Edge Of Software

by Warren Ernst

Inside The World Of Betas

Fortune-telling becomes an exact science when it comes to working with betas. This month we bring you four glimpses into the future of software.

Opera 7.0b1

If it seems we just reviewed the Opera 6 beta, it's because we did. Opera was apparently developing versions 6 and 7 at the same time, and although Opera 6's team was a little behind schedule, Opera 7's is a little *ahead*. Hence the new release, and what a release it is.

Opera 7 brings much more to the table, including an email client that doesn't feel tacked on, a newsreader, and an IM client. In short, version 7 proves Opera can make an Internet suite as comprehensive as the big boys.

Opera 7 looks much different, copying much from Apple's Aqua interface in terms of icons, buttons, and rich blue colors. This goes beyond skinning, as buttons even fade in with mouseovers. All the toolbars are drag-and-drop this time, too. The browser is still the fastest

around, especially on slower machines. The rendering engine is entirely new and does a good job. The browser offers more options for displaying pages in different ways (without tables, as a Lynx-like text-only browser, as a small screen in an embedded device, as a kiosk without scroll bars).

The email module can import messages and addresses from Eudora and Outlook Express and handle multiple accounts with aplomb. It lacks the ability to write HTML mail, complete with formatting; some will see this as a good thing, and some won't. The newsreader is as good as Outlook Express', and the IM client is a slimmed-down version of ICQ. Because there will always be a free version of Opera to check out, run out and do so pronto.



Official product name: Opera 7.0
Version # previewed: Beta 1
Publisher: Opera Software ASA
Developer and URL: Opera Software ASA; www.opera.com
ETA: Q1 2003
Why you should care: The best alternative browser just got better.

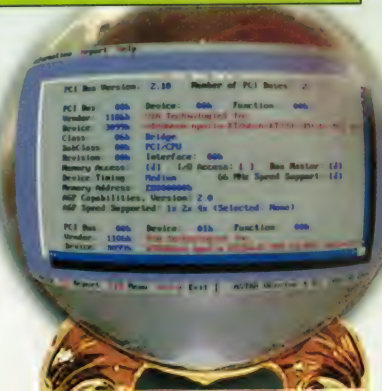
ASTRA 4.10 beta

If you deal with older (or brand-spanking new) PCs, figuring out exactly what hardware you're dealing with usually involves visually inspecting things inside. You can typically look at a Windows hardware properties screen, but that only works when the hardware is recognized *and* the hard drive has a copy of Windows installed and working *and* Windows isn't confused or lying about the hardware. For these situations, ASTRA (Advanced Sysinfo Tool & Reporting Assistant) is invaluable, doing a better job of sleuthing hardware and settings than anything I've seen. More amazing is that it works from DOS, fits on a floppy, and is easy to transport from machine to machine.

ASTRA identifies the vendors of memory SIMMs/DIMMs and their speeds, CPU step-pings and fabrication numbers, all the hardware IDs and memory locations of the PCI bus and every device connected to it, names, chipsets, sound card IRQ/DMA/address values, AGP modes and supported resolutions/refresh rates of video cards, and many more.

ASTRA's price seems steep at first (\$19, personal; \$39, commercial use), but the price gets you regular updates that guarantee that old, rare, and new hardware gets identified as the app evolves. In fact, if you're planning to install Linux on a relatively unknown computer, ASTRA can save you hours of headaches. Consider it an advance against the bottle of aspirin you would need.

Official product name: ASTRA 4
Version # previewed: 4.10 beta
Publisher: Sysinfo Labs
Developer and URL: Sysinfo Labs; www.sysinfofab.com
ETA: Q1 2003
Why you should care: Perhaps the best way to inventory a PC's hardware.



PopTray 2.10 beta 13

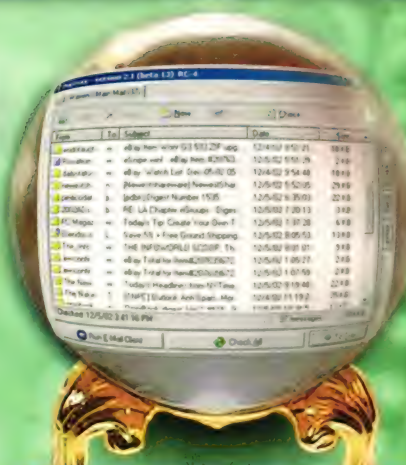
You know the drill: You're expecting an important email, so you click the "check mail" button every two minutes. Sure, most email programs have a "check mail every X minutes" command, but then you're wasting memory and CPU speed keeping Outlook open all the time. And, when you get right down to it, there isn't a lot of flexibility there.

PopTray is the Swiss Army Knife of background email checkers, providing every tool and option you've thought of, plus a few you haven't. For example, PopTray can check different email accounts for you at once, with different time intervals for each. It can play a different sound or display different Alert Messages for each account, too. For those who use a different email client for different accounts, it can launch whatever program you want for whatever account with a single click or when mail comes in.

PopTray speaks POP3 fluently, so it can read your

mail directly, displaying it in a small window without having to fire up *any* email program. If you want to delete it from the server immediately, it can do that, too. It can also take a special action, such as playing a special wave file, if it sees a message that's from a certain someone or has a subject with a certain set of words. Alternately, it can also *not* take action for some messages.

OK, so this isn't an application that's going to change the world, but the app's author seems to know this. The program is freeware and updated regularly. There's an active discussion and support board where users and the author brainstorm new features, discover bugs, and solve problems. The Read Me and History files are also humorous to browse. The program's source code is freely available, too (in Delphi, in case you're wondering.) All in all, this is one handy program.



Official product name: PopTray
Version # previewed: 2.10 beta 13
Publisher: Renier Crause
Developer and URL: Renier Crause; poptray.crause.co.za
ETA: Q4 2002
Why you should care: Who wouldn't want a handy, configurable, free email utility?



Official product name: Motherboard Monitor 5

Version # previewed: 5.2.1.0 beta

Publisher: Alexander van Kaam

Developer and URL: Alexander van Kaam; mbm.livewiredev.com

ETA: Q4 2002

Why you should care: The best way to check your computer's temperatures.

are measured.

For starters, this app is compatible with more than 70 different motherboard and sensor chipsets, which probably encompass hundreds of motherboards. Provided your board has one of these chipsets, MBM will display the CPU temperature, motherboard temperature at one or more points, hard drive temperature (provided you have a SMART-compatible hard drive), and the RPM of your CPU and case fans. MBM displays this information in numerous ways, including via the System Tray as a

Motherboard Monitor 5.2.1.0 beta

There are a lot of programs that monitor the temperatures inside your computer, but Motherboard Monitor is the classic tool for this. The latest beta proves why it's the standard by which all other hardware monitoring programs

dashboard of gauges with needles and dials or just as a straight set of digital readouts.

Several features set MBM apart. It has an open architecture so "helper" programs can read MBM data or send MBM information. For example, with a fan-speed plugin, MBM can tell a fan to speed up when the system is hot or slow down when things are cooler. The app can turn on a CPU-cooling HLT program if the CPU is too warm. It can also send readings to an external LCD screen.

MBM is still freeware, and the beta version I used was stable, polished, and well worth the download.

Send Us Your Betas

Know of software in the beta stage that's deserving of some attention? Let us know. We'll take a look at it and possibly give it a go-around. Send your prospects to bleedingedge@cpumag.com.

Imperfect Watchdogs

Under The Collar Of Spam-Busting Software

Yeah, we all hate spam . . . and the spam problem is only going to get worse. According to Jupiter Research, about 35% of the email most of us receive is unsolicited (spam, for example). In fact, unwanted email has gotten to be such a bad problem that even the mass emailers are concerned.

Last fall, the Direct Marketing Association, a trade group representing email and other direct marketers, reversed its longstanding policy to resist government regulation of email marketing. Now, the group admits, only some form of legal regulation is needed to keep the shady salespeople from sticking their foot in our inboxes.

But even mass emailers often say that the only sure solution to spam is on the client side—filtering out bad messages, either through filters a user's ISP imposes or on individual PCs via spam-busting software, such as the half-dozen applications I looked at for this review.

Although all of the programs in this round-up have the potential to be effective buffers against unwanted email, none of the applications will probably be satisfactory to most users out of the box. In all cases, spam busters either flag too much of your wanted email or flag too little of your unwanted email.

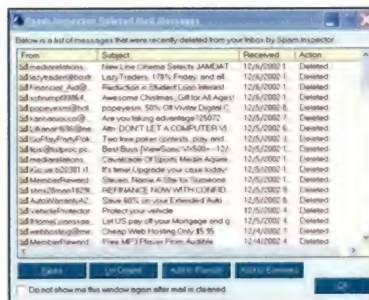
In scoping out a good spam protector, I discovered quickly that in this first generation of inbox filters, you should probably not look so much for a perfect automated solution as you should look for an application that is flexible enough to be taught new rules. These programs are a lot like watchdog puppies: Many of them have the DNA to be good guards, but they all require their owners' time and patience to train them to bark at the right intruders and not bite the wrong hand.

We tested each application on an Athlon 1.2GHz PC running Windows

XP Professional with 256MB of DDR SDRAM, a RADEON All-In-Wonder video card, and two 60GB Deskstar hard drives.

Giant Company Spam Inspector For AOL

The Spam Inspector line is actually the same software as iHateSpam (see the review on page 70), but it is marketed under its own brand here. Giant Company is the only outlet to offer this version for AOL users, and it is far and away the most elegant solution I have seen for that email client.



Spam Inspector For AOL

\$29.95

Giant Company

www.giantcompany.com



Spam Inspector works almost exactly the same way as iHateSpam works for Outlook, but Spam Inspector integrates fully with AOL versions 7 or 8. Once you install the program, the application sits neatly as a minimized window in the AOL Welcome screen. When you start AOL after installing Spam Inspector, the spam checker gives you the convenient option of adding your address book to a Friends list of email to let in, and the program even lets you designate which types of AOL special offer

messages you want to block from making it to your inbox.

Unlike most other spam blockers, Spam Inspector also scans your current inbox for suspicious messages and then moves those messages to a "quarantine" box where you can delete the messages if desired or teach Spam Inspector to accept the sender from that point on as a legitimate emailer.

Spam Inspector lets you set the filtering sensitivity to one of five degrees, ranging from extracting only known spam senders to filtering out all but known email senders, a setting that also catches most ads and newsletters.

I found that even the default setting of medium sensitivity quarantined much too much of my opt-in newsletter traffic, so I needed to teach the filter to permit most of the legitimate mailing lists I am on. This is true of most spam blockers, and one of the strong suits of this program is the ease with which you can teach it more refined filtering techniques. The quarantine box pretty much lets you click messages and tell Spam Inspector how to treat the message in the future. There are also basic settings for blocking messages containing various foreign languages.

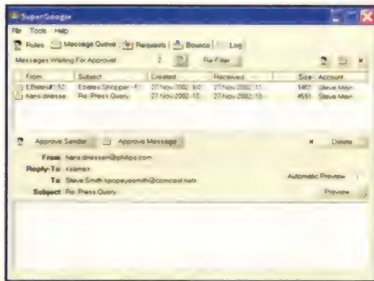
Within the limited universe of spam blockers that work within AOL, Spam Inspector is a clear favorite.

iMarketing Agency Supergoogie

For those who are obsessed with spam and want to make sure only the email you want gets through, Supergoogie is a thorough, albeit complex, solution. The program works with both standard email clients and Web-based email services because, unlike other filters, Supergoogie actually has you reconfigure these email programs to send messages to a proxy POP3 server where, by

default, it passes to your email client only messages from "registered" users.

When you install the program, Supergoogie asks you for your email accounts, servers, etc., from which it will pull down new email. You then redirect your email clients or your Web-based email accounts to look for email at the proxy Supergoogie sets up.



Supergoogie

\$39.95

iMarketing Agency

www.supergoogie.com



Meanwhile, Supergoogie is scanning all incoming mail before you get it and matching it against your address book. Supergoogie offers to import email account settings and address books, but it failed to find mine.

Supergoogie is unique in that it responds to all unrecognized senders by returning to their email accounts a request for registration. This process entails asking the sender to reply to the message and lets them state the reason they want access to your inbox. This ultimate solution could be very effective, but it is also heavy-handed, sending requests for registration to every new sender not in your address book. My correspondents were confused by it. Supergoogie leaves it unclear how this system handles opt-in newsletters, which are, after all, bulk emailed but permission-based.

You can disable the forced registration feature, but this declaws Supergoogie, leaving it more of an email previewing service that lets you view messages without attachments or scripts.

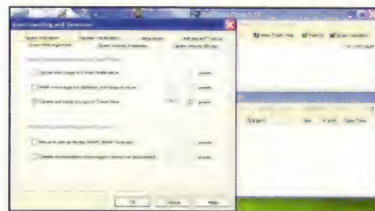
For those who really want a high level of security and don't mind having recipients register in order to send you email, Supergoogie is a watchdog of an unforgiving sort.

For those who really want a high level of security and don't mind having recipients register in order to send you email, Supergoogie is a watchdog of an unforgiving sort.

For most of us, however, this high level of security is a bit like walking around with your own muscled bodyguard: safe, but how do you explain this goliath to everyone you meet?

Lyris Technologies MailShield

MailShield is a versatile standalone client that works with POP3, MS Exchange, and Hotmail accounts. Installation requires you to set your server



Mail Shield

\$60 for single-user license

Lyris Technologies

www.lyris.com



and account information, but one of the neat things about MailShield is that it tests each setting along the way to confirm proper setup. The program also sets the filter sensitivity by asking you how much opt-in email you receive.

MailShield uses fuzzy-logic algorithms to recognize spam-like keywords in your email and assign them "spam points." You can make the program more or less sensitive by deciding how many spam points are allowable before

an email message gets filtered out. The program asks you to enter keywords that the program might find in your opt-in newsletter subject headings, such as a content brand (MarketWatch) or subject area (books). MailShield scans incoming messages before they get to your usual email client and scans the message header and body text.

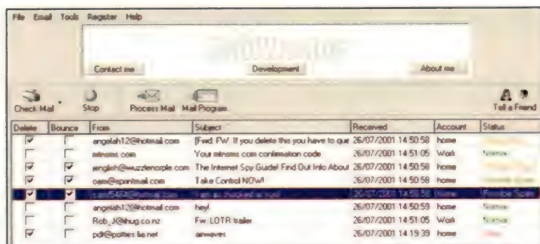
Frankly, the process of gathering together keywords from an inbox seems like a tedious and onerous task. MailShield does start you off with some common scamming terms in its default filters, such as "steady monthly income" in the headers area and "Viagra" in the message body filter areas. There doesn't seem to be a way of automating the process of adding keywords, however, so tuning the message and header filters to catch spam could be laborious.

On any incoming email messages that contain a number of blacklisted keywords, MailShield can run a DNS server check, which tries to send an email to the sender's address to verify its existence. In my tests, the program was very liberal about what it let come into the email box. It was smarter than most in letting through many of our opt-in newsletters, but it seemed as if it needed us to input quite a number of our own telltale spam indicator words for its spam-point count to get beyond the three required to designate the email as spam.

The upside to MailShield is that it is highly customizable, and it comes in workgroup and server versions, so IT managers can apply it company-wide. Otherwise, the application is a fairly high-maintenance pet.

MailWasher 1.33

MailWasher is a client that is separate from your own email program, but



MailWasher 1.33

\$10 to \$20 donation

MailWasher

www.mailwasher.net



it does not set up a proxy server as Supergoogie and Junk Spy do.

Essentially, MailWasher is an email program that you run before your own client. The program also lets you filter spam, preview suspicious or possibly dangerous messages, or bounce messages back to their respective servers before passing the messages on to your regular email client.

The program installs politely, automatically importing account and server information from your current email clients. Unlike some other applications, such as iHateSpam, however, the program doesn't import an existing contact list or addresses from a Sent box. This would be a lot handier.

MailWasher maintains a blacklist of email senders and types of email messages that are marked for deletion in the mail message box. You revise this blacklist by tagging incoming email messages as spam for future reference.

The program also uses the DNS databases at three major spam-tracking organizations to check for common spam senders. There are two basic filter rules that are turned off by default: block emails with cloaked recipients and email messages that are not addressed properly to you. You can tweak these filters by adding or removing phrases that MailWasher uses as spam tip-offs.

MailWasher also lets you bounce messages back to selected senders as a phony "recipient not found message" so that

bulk emailers may take your address off their lists. It also gives you nice email virus protection by letting you preview messages as text only and without potentially damaging script attachments.

For those who are paranoid about letting a spam filter pull email from your inbox or delete potentially valuable messages, MailWasher is a good rudimentary program that lets you review all incoming mail, preview it safely, and delete spam. On the other hand, getting the filters right takes a bit more work than some of the other spam blockers on the market.

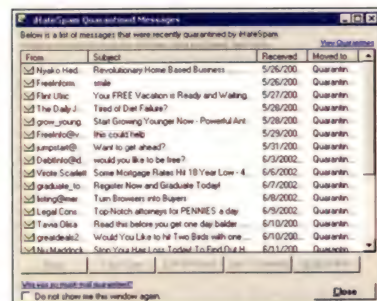
Sunbelt Software iHateSpam

iHateSpam is among the more popular spam-busting packages available, and deservedly so. The application is for Outlook and Outlook Express only and has different versions for each flavor of that Microsoft mail client. Because the application integrates entirely into the email client (and has a very user-friendly interface), the program is among the better solutions out there.

As an integrated solution, iHateSpam installs without requiring any server addresses and usernames and simply adds a toolbar to Outlook. The program scans incoming email and then quarantines questionable messages in a separate pop-up box where you can identify a message as an enemy missive that needs quarantined in the future, identify it as a friend to let through to your inbox from here on, or bounce back to the sender in an attempt to take yourself off the sender's list.

iHateSpam is among the most user-friendly programs I tried. It automatically puts email addresses from your contact and sent mail folders into a My Friends list of acceptable mail senders. In addition, the program lets you designate foreign alphabets to exclude from your email.

You do need to train iHateSpam. The program uses a Spam Definition Library to identify probable spam, and you can set the threshold to one of five levels, from quarantining all junk and most



iHateSpam

\$29.95

Sunbelt Software

www.sunbeltsoftware.com



opt-in newsletters to filtering only known spam senders. In my tests, the default setting was extremely sensitive. To its credit, the program didn't net in any personal email, but the default setting did pull in much of my opt-in newsletter traffic.

You can dial back the sensitivity so the filter catches only known spam senders. Beyond the basic settings, you teach iHateSpam by labeling the mail that it quarantines as friend or foe, not spam, or

For those who are paranoid about letting a spam filter pull email from your inbox or delete potentially valuable messages, MailWasher is a good rudimentary program that lets you review all incoming mail, preview it safely, and delete spam.

If spam is an inevitable part of our online future, it looks as if spam busting is going to be a bit of tedium we all will have to endure.

something to bounce back. The program also adds a toolbar to Outlook that lets you tell iHateSpam for future reference whether specific senders should be allowed.

Although far from an automatic solution to spam, I liked the program for its polish and seamless integration with Outlook. A nearly identical version of the program, Spam Inspector For AOL, is available from Giant Company (see the review on page 68).

Sundial Systems Junk Spy

Like Supergoogie, Junk Spy uses a proxy server to intercept incoming email from POP3 accounts before it gets to your client email program. This makes for highly effective protection but a more involved setup.

Junk Spy has the most extensive and clear documentation of all the programs I tested here. Although more complex than most, this installation routine has specific

the email client so that it retrieves new mail from the proxy server rather than directly from the mail server, usually a matter of changing the POP3 address and modifying a username.

Uniquely, Junk Spy scans incoming mail and then passes it onto your own mail client with a specific flag as X-Junkmail. You then give your client's internal email filter instructions about how to handle the spam suspects (delete, route to special folder, etc.) Other proxy solutions make the user juggle between the spam buster and email client.

Once you become comfortable with the decisions that Junk Spy makes with your incoming email, you can tell it to delete these messages before passing them on.

Junk Spy sports a very flexible and extensive set of detection routines. The program maintains keywords to look for in email, but it also lets you tweak these listings, create exceptions that tell the program when certain phrases are not spam, and even use a wizard that lets you cut and paste samples of email you want to receive into the exception filters.

The only major weakness seems to be that the program does not import a contact list. We also found that like many of these programs, many of our opt-in email newsletters got caught in the spam filter. Finally, the program's free trial demo mode is terrible.

Without a paid license, the program restricts its use by filtering only two spam messages a day, which is hardly enough of a trial for deciding whether the program will suit your needs or not. Otherwise, Junk Spy is an unobtrusive and thorough solution that, like all of these applications here, requires a little effort to work well.

Good Doggie

If spam is an inevitable part of our online future, it looks as if spam busting is going to be a bit of tedium we all will have

to endure. In spending time with this small kennel of email watchdogs, it was apparent that nothing currently in the market will clean your inbox effectively and reliably without a good deal of paper training.

You need to teach the overeager but nicely designed spam busters, such as Spam Inspector/iHateSpam, to let in more than they do by default. For other programs, such as MailShield, you'll need to teach new spam words to speak in order to do a better job. Not surprisingly, none of these programs rated above 3.5 CPUs, suggesting the general immaturity of the category for now. In the end, I still think that using the DELETE key in your inbox is as efficient a solution as we will see for a while. **CPU**

by Steve Smith

Infinite Loop

Huh? Come Again, Pal

We get tons of press releases and product pitches around here. Some contain real gems. Here are some highlights from the last few years.

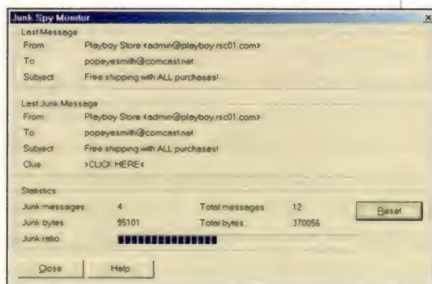
"... a hassle-free complete wireless networking solution for individuals with no previous networking experience, like students and stay-at-home moms."

"First, thanks for you visiting out booth in Comdex fall, it's our honor to meet the good partner like you in the worldwide."

"About half the size of your regular mouse, these are already very popular in Asia for children, and teenagers who want something cute and different."

"This program promises to reduce office productivity and clog up servers across the nation. I just hope my employees don't discover it!"

"These are one great products with PATENTS on it."



Junk Spy

\$59 for two licenses

Sundial Systems

www.junkspy.com



instructions for each of 15 major email clients, and the installation explains the concept of the proxy well. If only more of these programs were this considerate. For Junk Spy to work, you must reconfigure

by Chris Pirillo

It'll Last Longer

Eight-dot-three is a legacy naming convention, and one that's not likely to disappear anytime soon. But that doesn't mean we have to live with it longer than necessary. What does the filename IMG_1973.JPG tell you? Not much, admittedly. Almost certainly it was the 1,973rd photo taken with a Canon digital camera. Open that image in any viewer and you're likely to see 95% of its contents. So, what about the other five? That's hidden away in a nice little header we like to call EXIF (Exchangeable Image File). If your digital camera doesn't stamp one on each snapshot, upgrade. To check, you can hover your cursor over that JPEG's icon in Windows Explorer. If the extended information is present, you'll soon see the camera's exact settings at the time the shutter fired. Depending on your OS, you may have to use a capable, external viewer. Something like IrfanView would work. That is, unless you've already edited the image in an editor that doesn't acknowledge the extended information—mistake! Once you've lost it, you can't get it back. Choose your software wisely.

My number one pick at this point is PhotoMeister (for countless reasons). Download the full 30-day demo from photomeister.com and you won't balk at its \$55 price tag. (1) Navigate to any given folder on your system; (2) select from a list of thumbnails the photos you want to rename and optimize; (3) export your selection to a printer, Web pages, email, PDF, screen saver, EXE slideshow, CD, or an album for your Palm device. Yeah, it does all that and more. Adjust the contrast slider a couple of points and you've got something suitable for framing. When my mom visited San Francisco a few weeks ago, I dreaded sending her home to Windows XP's inadequate photo-management tools. I showed her what PhotoMeister could do, and she took to it like a geek to liquid-crystal displays. Now our entire family is enjoying her photographic adventures. Except for Grandpa. He's still afraid that a little robot will spring out of his floppy drive and eat his medicine. But that's another story.

There's nothing flashy about PhotoMeister; it works, and it works well. But for those of you who use a thumbnail viewer to visually browse

your collection, I have another recommendation: Picasa. How many pictures do you have on your hard drive? Go ahead; take a guess—you're wrong. Images are everywhere, even in places you didn't expect them to be. Picasa (\$30) will dynamically sniff out JPEGs on your system and show them to you in a straightforward manner. Or, if you love slideshow presentations, check out the dynamic Timeline feature. It's absolutely amazing; I'd expect nothing less from the people who once brought us Kai's Power Tools. This program can import pictures directly from a digital camera, batch-resize selected images, or send your memories to a photo-quality print service. Grab a 15-day trial from picasa.net and you'll soon wonder how you got along without it.

Picasa was designed with digital photo management in mind, so don't expect too many bells and whistles in the first version.

Organizational issues aside, let's have some f-u-n! When I think of those three letters,

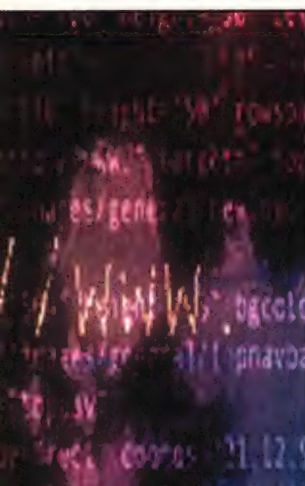
the first company that springs to mind is Alien Skin Software (found, oddly enough, at alien.skin.com). It has been producing Photoshop-compatible plug-ins for several years now, and it is showing no signs of slowing down. They're wacky, zany, and the software's just as good. I couldn't live without Eye Candy 4000 or Xenofex, and I'm thinking of picking up Splat! soon. Sure, your digital camera may have built-in sepia and solar effects, but we're talking about out-of-this-world tools that'll truly turn your photos topsy-turvy. Words can't do them justice. Then there's Repligator from Ransen Software (ransen.com); it's an automated image transmogifier that'll add just as much pizzazz to your pixels. Should you disagree with what it produces, click a button to move on to another effect (randomly or sequentially), or combine several filters to see what dreams may come.

Don't just dump those photos onto your hard drive—play with 'em, share 'em, and most of all, enjoy 'em. If you don't, I'll call this robot friend of mine. . . . ■

You can dialogue with Chris at chris@cpumag.com.



Chris, a newly initiated Californian, is the eldest son of Iowans Joseph and Judyth Pirillo. He has two younger brothers: Adam is biding his time in Des Moines waiting for his student loans to come through; Ben is teaching physical education in Plano, Texas. Gretchen, Chris' wife of four years, once admitted that having a tech-savvy spouse was a bonus. Oh, how was he initiated? Without provocation, a malted beverage was thrown onto his car as he drove through an intersection. True story.



News Of The World



Pete Loshin is a former technical editor of software reviews for BYTE Magazine (print version). Pete is also the author of "TCP/IP Clearly Explained" (4th edition available everywhere real soon now) and covers network protocols, security, and open-source software.

Item: Microsoft reports that Windows and Office franchises yield roughly 80% profit margins.

Drug dealers enjoy profit margins from 50% to 90% and more, depending on volume and risks; profit margins for more traditional businesses are usually in the single digits. Microsoft uses its Windows and Office profits to subsidize forays into other markets (including accounting software) by buying firms (like accounting software vendor Great Plains Software).

Search Google for "open source accounting" and at the top is a sponsored link to Microsoft's Great Plains Software. Could someone be getting nervous?

I skipped that one, and in a few minutes found three GPL'd accounting packages: Lazy Eight Ledger (www.lazy8.nu) from a Swedish outfit that warns the double-entry accounting program is for experienced bookkeepers only; a Canadian double-entry entry, SQL-Ledger (www.sql-ledger.com) that supports 19 languages; and U.S.-based NOLA (Noguska On-Line Accounting) from Ohio (nola.noguska.com).

All three packages support Windows, Mac, and *NIX with Web interfaces, but they also generate revenue for the publishers via support contracts, just like commercial software vendors.

Item: Microsoft generates "wins" in India by offering "free" software.

Give away the razor and sell razor blades. Give away the software, charge for upgrades.

There's a problem with "free" (as in "free beer") commercial software, whether given to India or your local school district: The first one is free, but everyone pays for the upgrades, not to mention the licenses you'll have to buy for your home or business to be compatible. So once India's hooked on Windows, Microsoft will have expanded its monopoly.

Meanwhile, most of India's billion-plus population lives in villages without electricity, much less reliable telecommunication links. With an average per capita income of about \$500, few Indians can afford the software, let alone the PC. If Windows edges out free alternatives in India, the digital divide may become completely impassable.

An alternative exists: the Simputer. In 1998, the Simputer Trust (www.simputer.org) began designing a cheap (under \$200) StrongARM-based computing device to bring the benefits of connectivity to developing populations. The Simputer is no PDA. There's no keyboard, but it has a high-res LCD screen and a nice

GUI that's easy enough for people who can't read to use—Indian illiteracy is high, and Indians speak dozens of different languages.

The Linux kernel powers the Simputer, along with the open-source IML (Information Markup Language) for developing content and applications. Perhaps more interesting is that the Simputer designs are also offered under an openish license to spur hardware manufacturers to produce "Simputerised" computers.

The specs are impressive: a 200MHz StrongARM CPU, 32MB of DRAM, 24MB flash memory, 320 x 240 touchscreen display, RJ-11, USB and Smart Card interfaces, all running on three AAA batteries. X Windows works, and other software includes imli, an IML browser; Dhvani, a text-to-speech program; and an elegant input solution, Tapatap. Similar in intent to Graffiti, Tapatap uses a 3 x 3 grid in which users enter English letters by tapping the grid in roughly the same shape as the letter.

That \$200 price point only works when these go into mass production; although nicely suited to personal use, Simputers are still too expensive for most

Indian villagers. Simputer founders expect that an entire village can share the cost and benefits of a single Simputer. With inexpensive Smart Cards available for a couple of dollars, each villager could keep his or her own data private yet still share the device profitably.

Currently, only two Indian hardware vendors have licensed the Simputer design: PicoPeta Simputers (www.picopeta.com) and Encore Software (www.ncoretech.com). PicoPeta offers development kits, but it may be awhile before you can buy one at your local big box store.

Item: Two Microsoft Internet Explorer vulnerabilities reported.

Item: Microsoft wants to partner with government to secure your data.

These two are just alarming. It's sad enough you can get arrested for bringing a nail clipper on an airplane, but do we really want to trust Microsoft to keep all our personal and private data (medical records, etc.) safe from unauthorized prying eyes? I sure don't. That's why I am a member of the Electronic Frontier Foundation (eff.org). ■

Get saucy with Pete at opensauce@cpumag.com.

**Give away the
razor and sell
razor blades.**

Words From The Web

YEAH, THEY ACTUALLY SAID THIS . . .

From an Excite message board:

For someone with the name "Whiners Suck," you sure do whine an awful lot.

*Irony on the Internet?
Say it ain't so!*



Infamously Internet-challenged Bill Maher during his MSN Celebrity Chat:

Hello Netjackers!

*Welcome to the 21st century, Bill.
Glad you could make it.*

From a Yahoo! Computer chat room:

Nooooooooo.....don't cancel your dial-up!!!!

*Yeah, dial-up is great.
Who needs broadband?*

From an Excite Trivia chat room:

The last 92 lines were typed by women.

Now if you'd only pay attention to what they were saying . . .

YOUR MOVIE DATABASE

Most savvy Internet users and film lovers are familiar with the Internet Movie Database (www.imdb.com), perhaps the best online resource for movie information. It was only a matter of time before some genius decided to piggyback the IMDb and create the YMDb (Your Movie Database), which you can find at www.ymdb.com.

Once you register at the YMDb, you can post a list of your 20 all-time favorite films and see how your list compares to that of other registered users. You can rearrange the order of the films with just a click or two, in case you accidentally place "Big Trouble In Little China" behind "Lord Of The Rings."

Buy and IMDb links appear next to each entry in your list. The Buy link takes you to Amazon.com so you can buy the flick, and the IMDb link takes you to the movie's entry on that site. You can also send an email to share your list with others because your friends love getting that kind of stuff from you. No, really. They do.

The YMDb's home page lists the most frequently visited lists, but you can also browse through a list of the site's users. I suspect that many of the user names are made up, unless there really is a Snake Plissken, who, incidentally, only ranked "Escape From New York" number 19 on his list.

Infinite Loop

I Need A Map To The Corner Pocket

Having trouble lining up the eight ball? No problem, if you have an electronic coach, that is. James, a virtual resident of the Aalborg University in Sweden, is a billiards guru that consists of a wired pool table, camera, laser, and computer. James appears on the monitor screen and gives you strategy tips, while the laser maps out your best shot. James is designed to be a billiards coach, but we wouldn't mind having him handy for a tournament or two.



Can They Do This?

The Drivers License Search Web site (www.DriversLicenseSearch.net) apparently has created a database containing just about every driver's license in the United States, including yours! The good news: You can look up just about anybody. The bad news: They can look you up, too.



EVIL CLOWN GENERATOR

I was terrified of clowns when I was a small child, so this evil clown Web site (www.scottsmind.com/evil_clown.html) stirred up some bad memories for me. Most of the randomly generated clowns also happen to resemble someone in our office, which is even scarier.



Everything ASDF

Who knew the first four letters of "Home Row" on a QWERTY keyboard were so-deep?
www.asdf.com

online BUBBLE WRAP

Not as much fun as the real thing.

WWW.SNAPBUBBLES.COM



WeatherBug

Temps & More From A Bug You Won't Mind Catching

As a general rule, PC users avoid bugs, hoping to steer clear of the latest virus incarnation. But there is one bug computer users may want on their PCs. In fact, more than 12 million users already have this bug, and they knowingly pass it along to their friends. We're talking about the WeatherBug, one of the surprise Web media hits of the last few years. According to traffic rating service comScore, the WeatherBug is the single most popular source for weather information online: bigger than better-known brands AccuWeather and even The Weather Channel's Weather.com. (See the "Sleeping Giants?" sidebar.) AWS WeatherBug receives between 15 million and 16 million unique users every month, in a league with MSNBC.com and CNN.com, and the WeatherBug first appeared only two years ago, in late 2000.

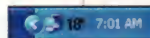
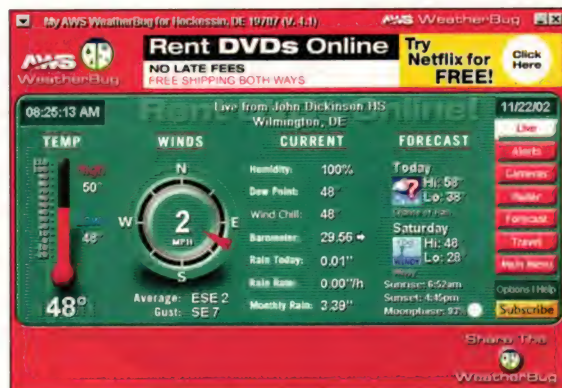
How does a relatively unknown media brand dominate the competition? Flat-out coolness. This Bug infests your system in a good way. The memory-resident utility is a Windows-only program that sits in the Taskbar as an icon in the form of the current temperature in your area, in many cases reporting from a weather center within miles of your desk. Click the icon, and the full WeatherBug appears, a 620- x 430-pixel window that is essentially a Desktop weather station. The main WeatherBug window is full of colorful, illustrated current temperature, wind, and atmospheric stats and also includes a two-day forecast.

Good enough, but then WeatherBug gets really cool. Drill down into one of the six other screens available, and you realize that you have a full-featured weather application sitting in your Taskbar stocked with live data. Click

Alerts, and national weather alerts pop up on a U.S. map. Click Radar, and the most recent local area radar screen snaps into an animation of the previous few hours of activity. Then there are the seven-day forecasts and the travelers' screen for calling up forecasts for wherever you are headed. WeatherBug also aggregates Web cam views from a host of local camera setups, many at schools and along highways. Better still, you can review the last few hours of shots from these cams in time-lapse view.

The Sly Bug

The technology behind this little marvel is as amazing as you would



The WeatherBug sits unobtrusively in the System Tray until you call it to duty. Then it makes available screen after screen of detailed, highly local weather info.



WeatherBug conserves bandwidth and background processing overhead by streaming only the most basic weather stats to the Desktop to fill the initial page of the console when it pops up. Subsequent pages, such as this set of local Web cam views, are HTML pages that make calls directly to the AWS servers when needed.

suppose, and in many ways, this little Bug is leading the way into new forms of broadband-based media applications. WeatherBug is the online arm of AWS Convergence Technologies, a company that supplies local weather

information to TV stations nationwide. Unlike other weather-gathering outfits, which tend to take their readings from large regional weather stations and airports, AWS installs its measurement devices in more than 6,000 schools, museums, and other neighborhood sites. In this way, AWS is likely able to gather and report the weather status literally within a few miles of your home.

The Bug itself is written in Visual C++, and a primary challenge for the coders at AWS has been to keep such a sophisticated always-on console as small and unobtrusive as possible. In previous iterations of what used to be called "push technology," content providers tried and failed to stream information at regular intervals to a user's Desktop rather than "pull" the user to a Web site. Companies such as PointCast never caught on in the mid-90s, in part because the concept played best on broadband connections, which were not as prevalent at the time. More important, older push technologies notoriously hogged desktop resources, glomming onto CPU cycles

and memory in order to keep those headlines coming in.

In its three years of development and four major releases (WB 5.0 may be available as you read this), Chris Sloop, CTO, AWS and his design crew put a premium on efficient coding. "It started off as a 3MB download," says Sloop, "but the size is about a meg right now." Designed mainly for the growing population of office and home broadband users (although dial-up Webizens will have no trouble using it), the chief challenge of writing this software was keeping it efficient within a user's Desktop but also always on. The trick is in orchestrating how and when the Taskbar Bug and the pop-up console pull current data from the WeatherBug servers. While in the background, the Bug polls AWS's servers every five minutes for any weather alerts, which will make the Taskbar Bug light up, and it polls for the latest basic weather info (temp, wind, atmospheric readings) every hour.

When users pop up the console, however, the Bug moves into live mode, grabbing information from AWS every 3 to 20 seconds, depending on current usage loads. One of the great efficiencies in the Bug is that only the first page of raw data represents what is fed to the client software every few minutes. The rest of the Bug is actually just a Web browser, so that the other screens in the console (such as radar and Web cams) are just HTML pages pulled into the Bug when the user pops it up. On our Desktop, Task Manager reports the Bug occupying only 6KB to 7KB when in the Taskbar and 15KB to 20KB when live.

A Constant Attack

The Bug may be a polite and efficient client on your Desktop, but it can be a nightmare on the back end. Between aggregating data from 6,000 weather stations in real-time and servicing an exploding customer base, Sloop recalls that by October and November 2001 "the infrastructure wasn't keeping up with the new installations, and every day it was a constant struggle to add



Sponsored by. . . The Bug's innovative use of integrated advertising, letting a single sponsor brand the entire console for a day, keeps the service free to users and profitable for the company.

new computers." A multimillion dollar investment in technology over the past two years finally led to two data centers for redundancy and overflow, both on

the east coast and both containing 100 servers. In any given workday hour, about 2 million people have their WeatherBugs running in the background on their computers, and this alone delivers 36 million hits per hour to the server farms. "A single server can get 500 to 1,000 requests per second," says Sloop.

In managing this relentless demand, AWS also offers a glimpse of the Web's future, the kinds of unique technical hurdles of a broadband medium that delivers persistent streams of information. "It's like a continuous attack of the WeatherBug," says Sloop. "The biggest thing with an automated application is that you can't stop or slow it down. If the program is running, then every five minutes it is going to check for alerts." AWS is able to slow the rate at



AWS CEO Bob Marshall: Web Profits? No Problem

Sure, the WeatherBug is cool, but can it make money in a medium that's already crowded with the gravestones of good ideas and bad business models? "It's operating very profitably," says Bob Marshall, CEO, AWS Convergence Technologies. "WeatherBug is acting like a media company, at pretty high margins, developing a pretty healthy cash flow. The Web business had almost no revenue in 2000.

[The Bug launched in late 2000.] It was \$3.5 million in 2001, over \$8 million in 2002, and [will] more than double next year."

The magic is in the "wrap," those single-sponsor placements that take over the Bug for a day. For repeat customers such as Verizon, Sprint, AMEX, and Netflix, there's nothing else like that kind of always-on brand exposure that people pop up multiple times a day. "This is the kind of thing that only broadband lets you do," says Marshall. Even without a broadband connection, however, the Bug's branding power remains because the client receives its advertiser "wrap" once every morning so that it appears every time you pop up the software, connected or not.

In fact, while other Web companies, such as AOL and RealNetworks, continue to think of broadband mainly as high-bandwidth streaming video and audio, AWS Convergence is one of the only Internet content providers to explore what may be the true killer app lurking within those fatter pipes: the always-on element. "The Desktop relationship is very unique," says Marshall. And AWS seems to be leveraging that relationship wisely by making the ads and the content simple but always available and keeping the Bug itself efficient and unobtrusive to users until they want it. How do you manage to please advertisers and users at the same time? "We clearly have very good, smart people," says Marshall. ▲



AWS Convergence Technologies' CTO Chris Sloop (left) and Chris McCown, WeatherBug Product Director, monitor the WeatherBug as it streams data to 2 million users at any given time during the workday.

which the Bug polls the servers, especially the live screen data updates, which strain the servers most.

The Bug may dazzle users, but for Sloop, "the coolest thing about the software is the way we gather data." Most of the 6,000 AWS weather stations stream the basic local information via the Web to the servers, while satellite feeds pull down the national weather service data (such as maps, alerts, and forecasts). In order to pass off the incoming weather stats to individual users, all of the current weather data from all of these sources stays in memory rather than hard drives. AWS coders wrote their own API so that incoming requests for local data can read directly from the cache. "I don't think I have seen anything so efficient in any program I have seen anywhere," says Sloop.

Maintaining a live nationwide network of 500 Web cams brings with it unique security challenges, as well. "There is the threat of hijacking a cam," says Sloop. In order to protect itself from pranksters inserting their own cams into the network, AWS runs authentication checks on all of the feeds to make sure that the images are coming from its own cams. Special coding ensures that the snapshots are coming from AWS's software.

Next-Gen Web Business

What other features can be crammed into one of the Web's most efficient always-on clients? "The big one is

launching a content area called 'WeatherBug Today,' a side window allowing us to put on more news and weather content," says Chris McCown, WeatherBug Project Director of the upcoming 5.0 update. And that console real estate is becoming ever more valuable. The company brags that it adds a "baseball stadium" of new users every day (50,000) and more people run their Bug each day than watch The Weather Channel. About 30% of these newbies come from referrals by current users. This Bug is catching.

Unlike many other Web operations, advertisers are lining up to buy space on this Bug, and many users actually like these ads. Beyond technical innovations, AWS is also teaching the Web some new business tricks. Rather than simple and annoying banners, WeatherBug sells fully integrated sponsorships to its pop-up console. Advertisers such as Benadryl, Scholastic, and Nexium literally take over the console, stamping the screen with their product's branding, colors, and sometimes even spirit. Each sponsor owns the day, and some of the treatments are very creative and colorful. One day Clifford the Dog may be sitting atop your WeatherBug console, turning the screen his signature yellow and red, while on another, all of the usual Bug navigation buttons might morph into the red flags of the British Airways logo. Far from intrusive, many users regard this new approach to online advertising as an entertaining way to have their free weather reports underwritten by a sponsor. It is also uniquely empowering because new users actually get to pick their own sponsor for the first week of use.

For all of its popularity and the increased demand from advertisers to ride this Web phenomenon, one can only wonder if success will spoil the Bug. Although it seems to happen infrequently, opening the Bug console can invite a pop-up ad, and the newer versions of the client certainly will make room for more of those lucrative ad placements. For its

Sleeping Giants?

Neither the Weather Channel nor AccuWeather got to be household names by letting no-name upstarts steal all of the good ideas. Both companies are trying to throw a cold rain shower on WeatherBug's impressive tech savvy with their own streaming solutions for weather watchers. See www.cpumag.com/cpufeb03/weatherbug for more. ▲

part, AWS is adamant that it is not going down the slippery slope of spyware, however. Although it did offer permission-based downloading of the controversial Gator program, the company stopped doing so a year ago. Moreover, AWS says that the client software is not capable of analyzing a system or monitoring a user's other online or offline PC habits. It simply knows whether the user logged on recently and needs to refresh the client data.

Of course, if users don't like ads at all and want their weather updates at an even faster pace, they can sign on for WeatherBug Pro, an enhanced, ad-free version (\$19.95/year) that premiered just last year. In a matter of months, the upgrade attracted 45,000 paying customers. Yeah, this Bug has legs. **cpu**

by Steve Smith

Infinite Loop

Lookin' For Love

Whether it's over the Internet or instant messaging with a wireless device, people are looking for love. According to a study conducted by Forrester Research, one in 10 Internet users in the United States looks for love online. But instant messaging seems to be taking a hold over the flirting market. When Velocity Communications asked the question "Have you ever sent a text message to tell someone that you fancy them," 40% of the respondents replied with a "Yes."



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Coder's Corner: XML

XSLT Part II: Recursive Processing

In Coder's Corner: XML, Ian Graham shows you how to program with XML. Ian is the author of numerous books pertaining to Web development, including "The HTML Sourcebook" and "The XML Specification Guide."

Last month we introduced XSLT (Extensible Stylesheet Language Transformations), reviewing the language's history and purpose. We also discussed the processing model by which an XSLT processor "applies" an XSLT style sheet to an XML document. We didn't discuss XSLT's most important feature: its innate ability to recursively process XML data. This month we'll introduce the recursive programming model of XSLT and use an XSLT example to illustrate how it works.

A Simple Recursive Transformation

The following example (simple.xml) will help illustrate recursive XSLT processing:

```
<data>
  data.text[1]
  <item>data.item[1].text </item>
  <item>data.item[2].text </item>
  data.text[2]
  <item>data.item[3].text </item>
  <item />
  data.text[3]
</data>
```

This document has a single data element containing text strings and four item elements, with some item elements containing text. The text of each text string describes (using an XPath-like notation) the position of the corresponding text node in the document. From an XSLT perspective, the data element contains seven child nodes: three text nodes and four element (item) ones. Consider this XSLT style sheet (simple-test.xsl):

```
<xsl:stylesheet version="1.0" xmlns:xsl="http://
www.w3.org/1999/XSL/Transform">
  <xsl:output method="text" indent="yes" />
  <xsl:template match="/">
    START (<xsl:apply-templates select="*" />)
    END
  </xsl:template>
</xsl:stylesheet>
```

An xsl:template element defines a transformation rule for generating output, with the match attribute defining, via an XPath expression, the nodes to apply the template to. This template then applies to the document's root node.

In XSLT, recursive processing happens via recursive use of templates. Each template can contain an xsl:apply-templates element that from inside that template invokes additional template rules. These rules can invoke additional templates rules, and so on. The result is a simple and elegant recursive-processing mode. Recursive processing can be confusing, and XSLT is no exception. The following explanation of the example style sheet should help make things a little clearer.

Recursion In Action

The XSLT processor starts at the document's root node and looks for a template matching the node. This is the template in the example style sheet. This template prints out the string START (and uses xsl:apply-templates element to search for additional templates to apply from *inside* this template. An xsl:apply-templates element first selects (via the select attribute) a list of nodes to apply templates to. In the example, the xsl:apply-templates element selects all child element nodes of the root node, namely the data element. For each node, the processor looks for the xsl:template

that applies to it. When it finds an appropriate template, the processor applies it to that node. Once the template finishes generating output, the `xsl:apply-templates` element moves through each node on the list. After processing all the child nodes, the template prints out `)END` to mark the template's end and the transformation's end. Here is the result of applying this XSLT to the example:

```
START (
  data.text[1]
  data.item[1].text data.item[2].text
  data.text[2]
  data.item[3].text
  data.text[3]
) END
```

The result is output between the `START (` and the `) END` strings marking the template's start and end (or the beginning and end of the start element). Where does the remaining output come from? The example style sheet doesn't contain any templates to produce this extra text.

Predefined XSLT Templates

The text comes from default template rules integrated into the XSLT specification and incorporated in all XSLT processors. Three default templates are used whenever the style sheet has no templates matching the nodes selected by an `xsl:apply-templates`. In the example, these default templates produce the extra text. The first default (we'll call D1) is:

```
<xsl:template match="/" | "*" >
  <xsl:apply-templates />
</xsl:template>
```

This template matches against the root node and any element node in a document and uses an `xsl:apply-templates` element to recursively apply transformations to nodes that are children of the matched node. Note that an `xsl:apply-templates` without a `select` attribute (`<xsl:apply-templates />`) selects processing instructions and *all* child nodes, including text, comment, element, and attribute nodes.

The example data's transformation begins at the style sheet document's `xsl:template`; it matches the document's

root node. This template prints the string `START (` and then uses an `xsl:apply-templates` element to select for the child element nodes of the root node. The data element is the only such element. The `xsl:apply-templates` element then looks for the template applying to this node. There isn't one in the document, so the processor uses the default rule D1.

This default rule takes the data element node and uses `xsl:apply-templates` to recursively select and process all child nodes. There are seven nodes in this list:

1. First text node
2. First item element node
3. Second item element node
4. Second text node
5. Third item element node
6. Fourth item element node (empty)
7. Third text node

The processor takes the first (text) node and looks for a template. There are no rules in the example that match to a text node, so the style sheet processor looks for an appropriate default rule. The following default template (D2) applies:

```
<xsl:template match="text()|@*" >
  <xsl:value-of select="." >
</xsl:template>
```

This matches text nodes and uses an `xsl:value-of` element to select the node's value and print it to output. For a text node, rule D2 transforms the node into an output text string (`data.text[1]`). The output contains the newline character because a newline is part of the text string (and puts the following `<item>` start tag on the next line).

The default rule D1 then moves to the second node in the list: the first item element node. The processor looks for a template rule matching this node, and the matching rule is the default rule D1. So, the processor recursively applies this same rule to this first item element. This node has only one child, a text node, so the `xsl:apply-templates` invokes rule D2, printing the string `data.item[1].text` to output. This text doesn't have a trailing newline, as there's no newline character inside the element.

Once the D2 template finishes processing returns to the D1 template operating on the item element, which finishes and passes processing back to the D1 template processing the list of nodes inside the data element. The pattern continues throughout the document. For each text node child of the data element node, the default rule D1 invokes rule D2 to process the node and print the text value to output. For each element node child of the data element, the default rule D1 recursively invokes the same rule (D1), which in turn invokes D2 on the text node content of that element.

The third default rule (not used in this example) mentioned earlier is:

```
<xsl:template match="comment() |
processing-instruction()" ></xsl:template>
```

This matches all comment and processing instruction nodes. The default rule does nothing. No output is generated, and the nodes are effectively skipped.

So Which Rule Applies?

Both the default rule D1 and the template in the example style sheet apply to the document's root element. So, why is the rule in the document applied to the root and not the default one? The XSLT specification defines a careful set of conflict resolution rules for determining which template applies. Template rules are given different priorities depending on where they are defined or how specific they are to a selected node. Thus a template rule in a style sheet always has higher priority than a default rule, while a template with a more specific match value (such as `match="/data"`) has a higher priority than a template with a less specific one (such as `match="/*"`). Finally, if two rules have the same priority, the processor always uses the last one in the style sheet.

Next month we'll apply these techniques to actually process XML data to create an HTML document. **CPU**

by Ian Graham

(NOTE: Full examples of the documents in this article are available at www.utoronto.ca/ian/articles/feb03.)

Planning A Flash Presentation

Flash is a tremendously powerful tool for creating immersive, interactive presentations either for your Web site or for a company demonstration. With Flash, you can design an imaginative interface—not possible with HTML—that delivers a lot of content in a smooth, animated environment that does not take up a lot of screen space. The best part about Flash is that you do not have to be a programmer in order to make gorgeous presentations!

Before you begin building your Flash presentation, you must first create a storyboard in whatever medium you feel comfortable with, even paper. A Flash storyboard is a little different from a site map you'd create for a Web site because in addition to showing any branching structure from your navigation, it should also show the key frames of linear sequences. In addition, Flash storyboards often have a lot of "production notes" in the margins next to each board that help explain the action taking place.

How To Begin

Start your Flash presentation just as you would a normal Web site. Make an outline that includes all of the content you will include. This way, you'll understand what kind of navigation structure you'll need in order to jet around from one section to the next. Once you understand the structure you need, you can begin work on the storyboards and, ultimately, the interface design.

Building Storyboards

To storyboard a Flash movie, I'll often make sketches on paper. To show a linear sequence like an opening animation, sketch three to four thumbnail-sized boxes stacked vertically. *Before sketching designs* in the boxes, write notes next to them about the kind of messages, visuals, and animations you think should appear there. If you begin designing at this point, it's easy to lose sight of the presentation's goals.

If your presentation is interactive, the bottom thumbnail should be your menu screen. Add notes next to this thumbnail that describe the navigation strategy. For example, because you are using Flash, you do not have to create a standard-looking "navigation bar" at the top of the screen. Instead, you could build a semitransparent disk in a corner that expands when you mouse over it and reveals navigation options. This is why it's better at this stage to just make notes about what kind of navigation options you need to have on the screen.

Below the menu screen thumbnail, draw a horizontal row of boxes that represent all the different places your presentation could go from here. Now, your storyboard will start to look like a site map. If any of the sections has a short animated segue, draw a vertical row of boxes that lead to the main page of that section.

With Flash, you do not have to create a standard-looking "navigation bar." Instead, you could build a semitransparent disk in a corner that expands when you mouse over it and reveals navigation options.

"Flashing" Out the Details

Now that you have a storyboard/site map hybrid that shows the overall structure of your presentation, start sketching the layouts of each thumbnail. Just as you would create a set of Web "wireframes," start a

new document with bigger boxes—one for each thumbnail box—and begin drawing.

During this phase of your planning, you can begin to strategize how you will build the artwork for your presentation. Flash has a rudimentary set of drawing tools, so I don't recommend using them for the bulk of your artwork. Fortunately, however, Flash can import a wide range of file formats so you can develop your artwork in almost any graphics or illustration program. I like to use Firework because I can develop both vector and bit-mapped graphics and import them over to Flash. Don't miss next month's articles on Flash development tips! ■

You can contact Lisa at lopuck@cpumag.com

Lisa Lopuck is now offering a beginning "Flash MX Primer" course at www.lopuck.com. Lisa is a long-time Web consultant, the author of numerous best-selling books on Web design, including "Web Design for Dummies," and a sought-after speaker at Web conferences and universities around the world.



onlnevdo.txt

Hollywood is scared of DVD. It is scared of the Internet. There's a lot of hype coming from both the information-wants-to-be-free camp and the fortress of the copyright holders. Both sides have valid points, and the answer is somewhere in the middle.

Here's the problem: Your average DVD is a couple of gigs. Over a modem, downloading that copy of "Harry Potter and the Chamber of Secrets" is going to take you 'til Tuesday. Over that shiny cable modem, it might take just a couple hours.

DVDs store video internally in MPEG format. This gives you a high-quality picture, but it sucks up the bits awfully fast. Scaling back the resolution of the film or switching to Sorenson-encoded QuickTime or DivX can get the files down to as little as a quarter of the size. Suddenly you can download that two-hour movie in real-time.

Now let's stir peer-to-peer into the equation, and you have Napster all over again. Hollywood is scared of this on several levels. First off, many popular TV shows are available online now. With the increasing proliferation of PVRs that can extract video (hacked TiVos or easier options like the EyeTV for the Mac), I was able to find and watch most of the first two seasons of Angel using a cable modem and some patience. This was great because at the time, my local cable didn't have UPN. I was left without Angel (or for that matter, Buffy, and a life without Buffy really isn't worth living).

Second is the copying of DVDs. This still hasn't become nearly as widespread, but the tools to extract DVD, convert it into a bandwidth-efficient format, and share it on a P2P network are rapidly becoming as commonplace as their audio brethren. Finally is the rarer problem of studio films being leaked before they even open in the theater. This problem is probably the hardest. Of course "Spiderman" and "Star Wars Episode II" each leaked many days before they opened with some of the highest grossing opening weekends ever.

Regardless of the source of the video, each suffers from the same serious lynch pin. Acquiring

these shows was a serious pain. Even at the top of the Napster explosion, users complained endlessly about the quality of the music they were downloading, inconsistent bit rates, broken ID3 tags, and worst of all, the lost 30 seconds at the end of almost every track. And the larger the files, the worse it gets.

This is where the networks and the studios have the chance to step in. People are willing to pay for this content if the price is right. We're paying our cable companies \$50 a month for cable. We pay that much for DSL and cable modems. Other folks pay for their usenet binary feeds by the gig.

Second, people should be allowed to choose how much they want to pay, and they shouldn't pay irrational amounts. The music industry still hasn't learned this. The major pay audio services still haven't realized that a song should cost a quarter. If a CD costs \$15 for 15 tracks, you can't charge a dollar a track because I'm not getting a CD. Charge a quarter, and suddenly everyone buys all

**People are
willing to pay for
this content if the
price is right.**

their music legally.

With video there are many tiers of service, and I think it should be tied to bandwidth. Let's say a dollar a gig. Buying a full DVD is going to cost maybe \$5. But if a user wants a DivX file or no Dolby Digital 6.1 THX audio, that file may only cost a buck. Users will pay it because it's cheap. The studios and networks don't have to pay to burn and ship DVDs. Users get their content now. And what's the point of pirating? The cost is so cheap that the convenience outweighs the benefit of piracy. Hell, throw a commercial or two at the front and end of the movie. We're used to it in movie theaters already.

The copyright providers need to strip down bare and make things so cheap that pirating the content becomes a waste of time. Because they won't have the cost of materials any more, Internet releases become almost pure profit. Everybody wins. ■

*Email me at malda@cpumag.com.
I triple-dog-dare you.*

Rob "CmdrTaco" Malda is the creator and director of the popular News for Nerds Web site Slashdot.org. He spends his time fiddling with electronic gizmos, wandering the 'Net, watching anime, and trying to think of clever lies to put in his bio so that he seems cooler than he actually is.

by Joan Wood

Ad Hoc Wireless Valentine



You approach the object of your desire and introduce yourself. You are charming, funny, smart, and courageous. Your palms do not sweat. You do not mumble or forget your name. In fact, you perform flawlessly because you are totally unaware of the whole automated process unless and until you receive a positive response to your offering. At that point, you turn and greet the redhead ordering a Big & Cheezy two cashiers over and smile. What happens next can be anything from finding true love to unloading the pair of Fijian skull-cracking war clubs you've been broadcasting for sale all afternoon.

Think about it. The day is near when your PDA/mobile phone/body piercing accessory will be capable of exchanging, locally with similar devices, personal broadcast message packets containing anything from a desire to share hobbies to your commuting transportation needs, and your preferred filtering app will announce any complimentary matches that happen to stroll by. Wrap your brain around filtered, highly personalized, wireless, local-area spam.

By combining future wireless wearable computing devices with automated peer-to-peer software agents, users will be able to query similarly equipped strangers to foster spontaneous interactions based around shared interests, needs, and goals. Stay on top of current research through the Wearable Computing group at the University of Oregon (www.cs.uoregon.edu/research/wearables) and sample virtual community builder/painted shoe wearer Howard Rheingold's writings linked from his Web site (www.rheingold.com) for interesting speculation on future directions.

The line that most research seems to be taking is based around joining an existing trusted group with similar interests and activities. We are already test-driving the group activity behavior on joint outings with our mobile phone text messaging friends. But as a lifelong certifiable techno weenie with a vested interest in anything

that enables geeks to procreate (or at least live more socially fulfilled lives), this new combination of technologies looks to me like it will enable the next thing after online matchmaking, instant message flirting, and phone sex. Only it will be up close and in person.

It is really not so great a leap. We already swap files with complete strangers on no more than the accident of common musical tastes. Rather than cast a wide net to find similar interests and commune virtually, this technology seeks out those in close physical proximity to test for compatibility of purpose. Although researchers are quick to name the more innocuous and uncontroversial uses for ad hoc wireless connectivity

like errand sharing and CD swapping, you can see the other shoe dropping from way out here. What happened with VHS and the Internet will probably happen with ad hoc mobile networks: Given the invisible, anonymous nature of this new communication medium, combined with the proximity requirements for participants, many users will likely not be

swapping music files but broadcasting, identifying, and exchanging (for want of a better term) romantic preferences.

As with all human encounters, trust will be one of the biggest issues, and proven methods like the reputation systems based on positive feedback for past transactions that work on auction sites don't have quite the same effect when applied to sex. So get ready to be a pioneer but be forewarned: If looking for dates on the Internet is weird, wait until you can swap genetic preferences while riding the subway.

Of course, I am the old-fashioned romantic type and met my husband-to-be after he was one of 200,000 people who downloaded my game demo. Now that's a big net.

Happy Valentine's Day! ■

**The next thing
after online
matchmaking,
instant message
flirting, and
phone sex.**

Send hearts & darts to joan@cpumag.com

Starting as gopher for the Emmy-winning team that pioneered live in-car TV cameras for the Indy 500, Joan became an independent video/sound engineer, technical director, and producer. Playing with Reality Engines and motion platforms led to co-founding Xatrix Entertainment, where she produced the two Cyberia games. Before 3D acceleration was trendy, she formed Mango Grits to develop hardware-only game Barrage for Activision. Since cashing out from SharkyExtreme.com, where she was co-founder and managing editor, Joan has retired.

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PROVEN SOLUTIONS FOR STORAGE MANAGEMENT

Road Warrior

Dual-Mode Notebooks, Low-Cost Pocket PCs, Palm On The Wrist, Patents & More From The Mobile Front

Dual-Mode Notebooks

We love wireless as much as anyone, but it does have its ugly side, with network compatibility often being the biggest problem. Dual- and even tri-mode mobile phones help bridge these compatibility problems by supporting more than one wireless network.

We're beginning to see similar problems with 802.11 wireless networks. The 802.11b specification made it to market first and is used widely in homes, offices, and public venues, but it operates in the congested 2.4GHz band and has a top speed of just 11Mbps. Enter 802.11a, which operates in the less crowded 5GHz band and has a top speed of 54Mbps. The problem is that 802.11a is just now becoming available, and it's not compatible with existing 802.11b networks.

The solution is dual-mode chipsets. At Comdex, Toshiba (www.toshiba.com) announced plans to sell a Satellite Pro 6100 with support for 802.11a and 802.11b. The model was scheduled for release before the end of 2002, so it should be readily available now.

Dual-mode notebooks should get a further shot in the arm when Intel releases its Baniya processor in 2003. Intel's Calexico project will support 802.11a and 802.11b in a single chipset. Intel will test Calexico with Baniya and sell the two as a single package to OEMs.

Throw in the emergence of 802.11g next year and things become really interesting (802.11g attempts to bridge the gap between the 802.11b and 802.11a specifications). Atheros Communications' (www.atheros.com) AR5001X chipset provides support for 802.11a, 802.11b, and 802.11g specifications. It even supports draft specifications for 802.11e, 802.11f, 802.11h, and 802.11i. Anyone else have a headache?



Atheros' AR5001X chipset includes support for 802.11a, 802.11b, and 802.11g. It even supports current draft standards for future members of the 802.11 family.

A Road Warrior Public Service Announcement

For those who indiscriminately substitute the term "laptop" for "notebook," we implore you to reconsider. Reckless use of the term "laptop" can have dire consequences, as a Swedish scientist found out in November. After taking the term a little too literally, the scientist developed burns on his, ahem, groin, while working on a paper.

This public service announcement comes via LapWorks (www.lapworksinc.com) and its Laptop Desk v.2.0 (\$29.95). The Laptop Desk isn't fancy, but it does help keep your lap cool. The new version also doubles as a desktop stand with an adjustable typing angle, and it fits easily in most notebook cases. If you prefer something a little more substantial, the Intrigo Lapstation (www.intrigo.com) includes fold-out

CrackBerry To Walk The Green Mile?

Research In Motion received a blow in November when a U.S. District Court jury in Virginia found the company had violated five patents belonging to NTP. The ruling requires RIM to pay \$23.1 million in damages. The kicker is that NTP claims it will seek an injunction to block the sale of BlackBerry devices in the United States, although there is a great deal of skepticism that NTP will follow through with its threat. As if we even need to tell you, RIM plans to appeal.

RIM is quick to point out that this is just round one. Charles Meyer, RIM's chief legal officer, has pointed out, "Decisions of trial courts are often reversed or modified in the appellate

court due to the technical complexity of the subject matter and the relative infrequency of patent trials at the District Court level." Mike Lazaridis, RIM's president and co-CEO, stated that the jury decision has no impact on the company's pending patent disputes (sorry, Good Technologies).

legs so you don't have to rest the tray in your lap. The Lapstation, however, is a little more expensive, costing from \$69.95 to \$139.95.

In case you're wondering, yes, we are aware that it would've been appropriate to title this section after Jerry Lee Lewis' most famous song, but that might have been a copyright violation, and in this case, a copyright actually working for the cultural good.

Wrist-Sized Palm

This past summer, we chided Fossil's (www.fossil.com) Wrist PDA for carrying the idea of a digital assistant a bit too far (July 2002 issue). At COMDEX, Fossil announced it had something new up its sleeve (pardon the pun). The new version of the Wrist PDA includes a 33MHz Dragonball VZ processor, 2MB of RAM, 2MB of flash memory, and Palm OS 4.1. That's right, the new version of the Wrist PDA is as much a PDA as, well, your PDA.

The watch includes a touch screen display built into the band that lets you enter data using Graffiti. A rocker switch aids in navigation. The watch can run any Palm OS application, but Fossil recommends you use third-party software specifically designed for the watch (software designed for the smaller display and rocker switch). The watch has a reported battery life of approximately four days and includes a rechargeable Li-Ion battery.

On the downside, the watch is a little large (for a watch, at least), measuring 2.01 inches high x 1.38 inches wide x 0.49 inches deep and weighing 5.7 ounces with the stylus. We're not sure how well the touch screen will hold up after you bump it into a wall a few times. Fossil will sell the watch under its own brand and its new ABACUS brand. Expect availability around mid-2003.



At COMDEX, HP announced two new iPAQs. The low-end h1910 (left) sells for \$300 and includes a 200MHz X-Scale processor and 16-bit transreflective display. The iPAQ 5450 (right), runs \$700 and includes a 700MHz X-Scale processor, Bluetooth, and 802.11b support. Enjoy.

announced its own line of new Pocket PC devices.

Dell's new Axim X5 Pocket PC comes in basic and advanced flavors. The basic version includes a 300MHz X-Scale processor and 32MB of RAM for \$249. The advanced Dell version includes a 400MHz X-Scale processor and 64MB of RAM for \$349.

But Dell doesn't have the only low-cost Pocket PC model on the market. HP announced the release of its iPAQ h1910 Pocket PC in November.

The h1910 includes a 200MHz X-Scale processor, 64MB of RAM (only 46MB of RAM is available, however), and a 16-bit transreflective TFT display for \$300.

Unlike HP's earlier attempts at a low-cost Pocket PC (the Jornada 525), these low-cost models are actually appealing. HP also announced its iPAQ h5450 Pocket PC at the same time. This high-end Pocket PC includes a 400MHz X-Scale processor, 64MB of

Treo Gets A Boost

Handspring has been saying for some time now that the Treo would support GPRS with a software upgrade. Well, that upgrade is finally here for T-Mobile users. Treo owners on a T-Mobile network can now download the upgrade at www.t-mobile.com/treoupgrade.

The upgrade is free for all Treo 180, 180g, and 270 users. The Treo 300, of course, runs on Sprint's 1xRTT Vision network, so the GPRS upgrade is not only unnecessary, it is also completely incompatible. If you are on T-Mobile's network, on the other hand, go get the upgrade if you haven't already.

RAM, integrated 802.11b, and Bluetooth for about \$700.

Given the falling prices of the Pocket PC and the rising prices of new Palm OS 5.0 hardware, there appears to be more overlap than ever between Pocket PC and Palm, putting the two platforms in even more direct competition.



Dell's new low-cost Pocket PC comes with either a 300MHz or 400MHz X-Scale processor and sells for \$249 or \$349, respectively.

New Pocket PCs

Does it seem like there are a surprising number of new companies jumping into the wading pool that is the PDA market? In 2002, Toshiba made a splash with its new line of Pocket PCs, and in November, Dell (www.dell.com)

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At Your Leisure



Plug In, Sit Back & Fire Away

The entertainment world, at least where it pertains to technology, morphs, twists, turns, and fires so fast it's hard to keep up. But that's exactly why we love it. For the lowdown on the latest in PC entertainment, DVDs, consoles, and just stuff we love, read on.

Age Of Mythology Godlike Gaming

Ensemble Studio's latest RTS is fab. This game is as good as we could have imagined, but let's not get carried away. If you consider yourself a fan of RTS games, skip the review below and buy Age Of Mythology now.

Ensemble has gone 3D for the first time; with default settings you might even

You will control Greek, Egyptian, and Norse forces in a story-driven campaign mode spanning 36 missions. Gain favor with the gods and build mythological units (minotaur, cyclops, centaur, Medusa, chimera, and tons more). AoM gameplay elements can be very complex, but gameplay and controls are intuitive. Novice players will have as much fun as veteran RTSers, and that element alone should pull in more gamers.

As you may already know, the 2002 list of top RTS games is very short: Warcraft III (reviewed Oct.

2002 issue) and AoM. We dare say that AoM will be spending more time on our hard drive than the eminently playable Warcraft III; yep, AoM just has that much more depth. AoM sets a new gameplay benchmark for the genre. That said, we look forward to seeing what EA pulls out of its development hat with Command & Conquer: Generals this spring.



Age Of Mythology (PC)

\$49.95 • Microsoft

www.ensemblestudios.com/aom



Epic battles are the order of the day in this soon-to-be RTS classic.

briefly think the graphic engine is a heavily updated version of Age Of Empires II (perish the thought and wait until you see the waves gently lapping up on the shores). Unlock and rotate the camera to see the improved details in the characters. It all looks so utterly splendid. And you're no longer playing in (some may think dry) realistic historical situations; gameplay is now all based in a time that predates all previous Age Of Empire games.



DVD Byte by Todd Doogan

Here's to hoping that time is on your side, because without a time machine, you'll be spending about 16 to 20 hours dedicated to nothing but the "Back To The Future" Trilogy DVD box set.

Universal really went full throttle putting this set together and stacked all three films together with a huge surplus of extras. You get film-specific extras on each disc, along with beautiful anamorphic (16 x 9) transfers and some truly encompassing DTS 5.1 sound fields.

All three films boast commentaries from producers Bob Gale (who also co-wrote) and Neil Canton, as well as a series of Q&A sessions with



director Robert Zemeckis and Gale, where just about everything you ever wanted to know about the films is answered.

THE DIGITAL BITS
we know dvd

But in case there are things you still want to know, each film features its own making-of documentary made during the film's production. Animated anecdotes (a pop-up video feature) are also available during the run of each film. There are also enough design featurettes, music video outtakes, DVD-ROM features and deleted scenes to clog up the fuel injection system of a DeLorean.

Fans of this fun series will love this set. ▲

Xbox Live Online Gaming For The Unwashed Masses

Microsoft had been dishing out the hype on Xbox Live since last summer, and we're happy to say it delivered on its promises with Xbox Live. The small unassuming box came with a few CDs, a headset, and instructions. (NOTE: *The Xbox has a built-in broadband Ethernet adapter, and you must have a broadband connection to use Xbox Live. Get more details here: www.xbox.com/live* /connect). Not one to RTFM, I connected the Xbox to a LinkSys BEFSR41 router, stuck the primary CD in the Xbox to start playing a game, selected the option to create a new account, and was prompted to create a unique Gamertag (handle by which you will be known on the Live! service) and set up an account. If you have an Xbox and an Xbox-enabled game, you can buy your starter kit at www.xbox.com/live/now (Microsoft will provide your subscription code online so you don't have to wait for the snail mail package to use Xbox Live).

A few minutes later I revved up the bundled MotoGP: Online Demo and was off racing (and wrecking) my bike within

minutes. I tried full versions of Microsoft's MechAssault (good stuff!), Infogame's Unreal Championship, and Sega's NF2K3—all without problems. Thanks to the hard drive, Xbox Live will also make downloadable content available for games. You can expect to see some Premium Content (translated: content you can buy) in the future.

Let's not forget the Xbox Communicator. This futuristic headset connects to your game controller so you can chat with players online in chatrooms or during gameplay. I was a bit apprehensive to be talking to a bunch of strangers online (remember what mama always said), but it worked out quite well. The voice quality is really no worse than your typical cell phone conversation (so quite good) and players can choose to mask their voices if they want. To talk, just press a button and speak as long as you please; when you're done, just hit the button again and you will be muted to other players.

Technically, this feels like a very smooth launch, and the folks at Redmond



CDs, instructions, and your headset = \$50. Multiplayer console goodness = priceless.

have done a solid job with Xbox Live. If this is just the beginning, I can't wait to see what the future holds (beyond A-list titles such as Halo 2, Star Wars Galaxies [MMORPG], and Midtown Madness 3) for the unwashed masses. Now go on—take a shower, and then hit the couch for some online multiplayer fun. I'll be seeing you online.

Xbox Live (Xbox)

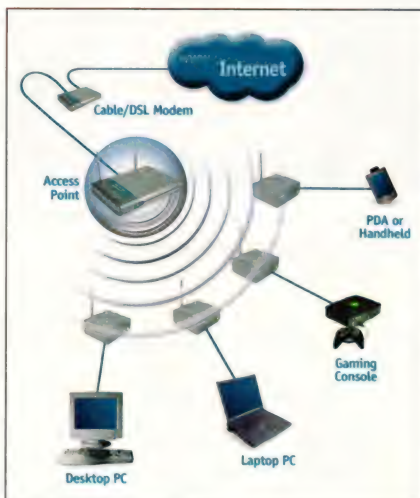
\$49.99 (includes one-year service) •

Microsoft

www.xbox.com/LIVE

D-Link DWL-810 Wireless Bridge To Console Gaming

So you're as excited about Xbox Live as we are, eh? Pardon me, what's that? Your spouse finds that 25-foot Ethernet cable lying across your living room (and child) annoying? You have no clue how to snake a CAT5 cable through your walls? You just want to get online now and skip this clichéd intro? Well, there's no need to be rude! The answers to your aforementioned problems come in the tiny box that is D-Link's DWL-810 802.11b Ethernet-to-wireless bridge. It might be a mouthful, but it's also as plug-n-play as devices get: plug it into the back of your Xbox (or PS2, if you purchased the additional adapter) and make sure you have a wireless access point in



Clean up for half the cost of a good console.

your home (we used a D-Link AirPlus DWL-900AP+ Access Point with our LinkSys BEFSR41 router). Got everything connected and powered on? Good.

We threw in MechAssault and had already forgotten we were connected wirelessly within minutes. Lag was not noticeable and gameplay was indistinguishable from our original connection via the 25-foot CAT5. Hours of testing later, we emerged satisfied. The DWL-810 is expensive for a device marketed for console gaming, but you also use it with your PCs at home and for some of you, wireless connectivity will usher in peace of mind, and hey, that's priceless.

D-Link DWL-810 (PC/Consoles)

\$129 •

D-Link

www.dlink.com/products/dwl810

Resident Evil 0 Capcom Does It Again

Resident Evil 0 is a GameCube-only prequel to Capcom's hugely popular Resident Evil survival horror saga. The game puts you in control of S.T.A.R.S. Bravo Team member Rebecca Chambers and a new character named Billy Coen after Bravo Team's chopper goes down in the forest surrounding Raccoon City.

Although it provides plenty of surprises in the form of new gameplay elements, monsters, and new storyline information, RE0 is similar in many ways to past RE titles. For one thing, the series' traditional control scheme is mostly unchanged. It might have been nice to see revamped controls more in the vein of Devil May Cry, but the old-school RE controls are adequate most of the time and certainly aren't enough of a drawback to ruin the fun you'll have with this game.

The resplendent graphics are on par with those of Capcom's recent GameCube remake of the original Resident Evil (see



our July 2002 issue for our review), as are the highly atmospheric music and sound effects. As in the remake of the original, Capcom has dramatically improved the quality of the series' script and voice acting. (The cheese factor is still a little high in parts, but this works well with RE's B-movie presentation formula.)

Chief among the game's new features are a dual-character system (that lets you switch between characters when needed or have them fight side by side) and a more realistic scheme for storing items and ammo (which lets you leave

Resident Evil 0 lets you fight T virus monsters using two characters at once.

items on the floor of any room and come back for them later).

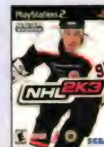
Both are welcome improvements over past installments, but the thing that really makes RE0 compelling is its all-new environment and storyline. RE0's environs are similar to areas explored in past RE games, but the chance to explore new places and uncover more about the origins of Umbrella (and the villainous Albert Wesker) makes this game an essential purchase for diehard RE fans and first-timers alike. For our full review, visit At Your Leisure online.

Resident Evil 0 (NGC)

\$49.99 • Capcom
www.capcom.com

Check These Out On The Web

See our reviews of LucasArts' *Star Wars Bounty Hunter* (NGC, PS2), LucasArts' *Star Wars: The Clone Wars* (NGC, PS2), Universal Interactive's *Spyro: Enter The Dragonfly* (NGC, PS2), and Sega's *NHL 2K3* (NGC, PS2, Xbox) at www.cpumag.com/cpufeb03/gamereviews.



Red Faction II Stickin' It To The Man

Red Faction II, THQ's sequel to the PS2's first really good FPS, is all about action. That's not to say there's no story involved; you play as Alias, a nanotech-enhanced super soldier and demolitions expert that goes from company man to rebel and joins the effort to end the rule of Chancellor Sopot, who apparently is not a very nice guy.

This familiar storyline (remember Deus Ex?) is a bit cliché, but it is an adequate vehicle for moving from mission to mission. As Alias, you'll help Red Faction achieve its anti-Sopot goals by blasting enemy troops, vehicles, and mutants with a pleasing variety of high-tech weaponry and vehicles. You won't drive most of the vehicles, instead serving as gunner for Shrike, a crack pilot voiced by Jason Statham ("Snatch," "The Transporter," "Ghosts Of Mars").



Red Faction II's advanced weaponry gives new meaning to the term "anti-personnel."

We're generally not crazy about games that put you on rails and ask you to shoot a bunch of pop-up targets, but RFI manages to pull it off rather nicely. Statham's character adds a bit of humor, and the weapons at your disposal are satisfyingly destructive.

And, of course, the vehicle levels are scattered here and there in between the meat of the game, which consists of fast and furious FPS action. The game looks and sounds great, provides simple, smooth controls, and includes a beefed-up version of the Geo-Mod engine, which lets you destroy most everything around you. Geo-Mod also lets you revise your path through many levels by blowing holes in the walls and creating shortcuts.

Add to all that a healthy complement of multiplayer options and you've got a very solid FPS that doesn't break too much new ground but will satisfy even the twitchiest of trigger fingers.

Red Faction II (PS2)

\$49.99 • THQ
www.redfaction2.com

Hot Shots: The Beauty Of The Game

Yeah, we know it's all about the gameplay. Sure, there are those who would have you believe graphics are relatively unimportant in the greater scope of things, but if you read *CPU* mag, you probably already know those folks are off their collective rockers. We want great gameplay combined with stunning graphics, and here are two upcoming games that show promise. Watch for them.



Planetside (PC). Head over to <http://planet.side.station.sony.com> to look into Sony Online Entertainment's upcoming MMFPS. Unlike Everquest (its current and only claim to fame), Planetside will focus on getting squads of players gaming with haste. Your characters can increase certification and gain access to vehicles and other special skills. Play starts in March 2003.



Breed (PC/Xbox). The game, developed by Brat Designs, is showing promise. The classically unoriginal storyline is forgettable, but the game's Mercury engine shows off good detail and gigantic levels.

Infinite Loop

Looking For Love

Valentine's Day is around the corner, but it can be hard work finding true love. Here are just a few of the ways people around the world use technology to help them with their affairs of the heart.

— In Sweden, you can use your cell phone to create a personal profile for a cell-phone-based dating service. When two compatible cell-phone users are close to each other, their phones ring and display a message. The two can call each other to talk or arrange a nearby meeting place.

— Remember Tomagotchi? Bandai, the same company that made those virtual pets, now offers Japanese men a service called Love By Mail. Instead of feeding and disciplining a virtual pet, a man sends email messages to a virtual girlfriend.

— Women aren't left out of Japan's virtual dating craze. A service called My Prince is the equivalent of Love By Mail, letting a woman select and send email messages to a virtual boyfriend.



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SOFTWARE TIPS & PROJECTS

Random Acts Of Tweaking

IF GOD HADN'T INTENDED PC ADDICTS TO TWEAK THEIR OPERATING SYSTEMS, HE WOULDN'T HAVE INVENTED WINDOWS. OH, WAIT A MINUTE; BILL GATES INVENTED

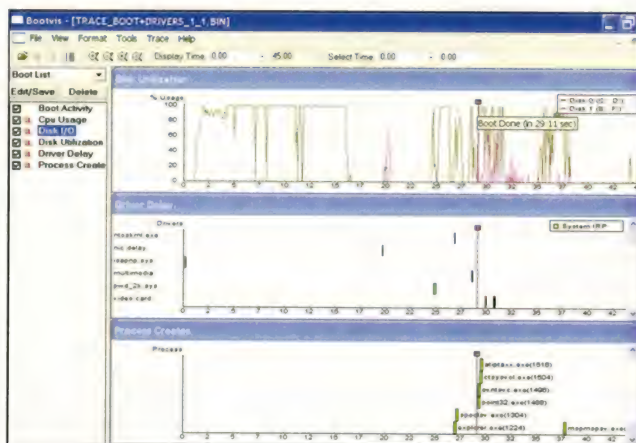
Windows. It's so easy to get them confused. . . . Regardless, even the most die-hard Redmond-bashers seem to admit now that XP was a worthy upgrade: it starts faster and it's more stable, customizable, and secure than previous versions of both consumer- and business-grade Windows. But that doesn't mean that there isn't room for lots of tweaking in XP.

Since its release last year, we have been gathering up reader questions about the OS and test-driving a host of performance tweaks and little-known programs within XP. Now that we've been using XP for a while and know how the manufacturers want it to perform, let's pop the hood on this baby and see how we can play with its innards.

The Bootvis Difference

PCs are smart and getting smarter, but they still can't do what a TV, radio, or microwave can do: be up and running at the flick of a power-on switch. Granted, Win XP does make boot time a little less arduous, but even its shorter startup routines are a far cry from what should be a technophile's birthright: instant-on computing. But why do some machines take so much longer than others to boot? You can get a handle on your own PC's boot process by using a little-known but very useful utility called Bootvis from the Microsoft site.

Bootvis records your WinXP boot process and presents a detailed analysis of which drivers load into memory when and whether the drivers cause undue delays. To download the program, go to www.microsoft.com and type **bootvis** into the search box. The program should be the first search result.



Bootvis is Microsoft's own well-kept secret, a tool that analyzes your XP system's boot process to identify choke points and sluggish drivers.

Once you have installed Bootvis and closed all other programs, start Bootvis and choose Next Boot + Driver Delays from the Trace menu. Click OK to reboot your PC automatically but with Bootvis analyzing in the background. Be very patient. When the machine reboots and your Desktop pops up, do nothing until Bootvis restarts by itself. This can take a minute or more. Bootvis renders several screens of data on the CPU load

and hard drive activity involved during your boot process. Each window has a vertical line traversing the chart and topped by a small square. Mouse over the square to find your boot time. Either save this Bootvis results file or write down that boot time so you can compare it to your post-tweak scores.

Tweakers can use the Bootvis windows to identify possible choke points in their boot process. The Driver Delay window graphically displays how long it takes major subsystem drivers such as audio and video to load. This is a spot where you might try older or newer versions of those drivers to realize faster boots.

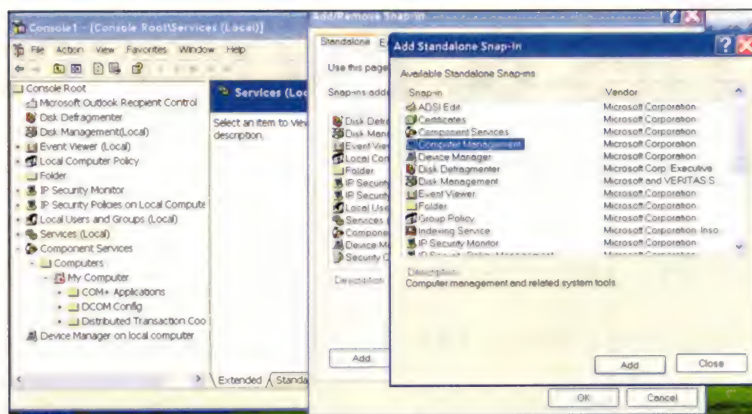
We have gotten mixed results from Bootvis' own optimization scheme. It purports to reorganize your more critical boot files on a faster portion of your hard drive. Use the Optimize System command under the Trace menu to try it for yourself but don't expect miracles. Other users claim it took five or more seconds off of their boot time, but we only saw between one- and two-second gains on our systems.

Roll Your Own Console

The Microsoft Management Console is one of our favorite recent XP discoveries, and now we can't live without it. This carryover from Windows 2000

lets you build a console of administrative tools and monitors for your system. In other words, rather than drill around to find the Group Policy Editor or Device Manager every time you need them, the MMC aggregates these and many other functions into a custom console. To start, type **mmc** in the Run dialog box.

You build an MMC by using the Add/Remove Snap-in command in the File menu. In the Add/Remove Snap-in dialog



The MMC (Microsoft Management Console) lets you aggregate some of XP's best administrative, monitoring, and built-in tweaking tools.

box, click Add to bring up a list of all the available standalone snap-ins that you can plug into the console. Highlight any one of these items to see a short description of its function. Some of the snap-ins are a bit arcane, but you can pull together common administrative tools such as managing services, monitoring shared files on a network, and disk defragmenting and management. Adding these elements puts them into the Console. Use the MMC Help file as a guide to each of the snap-ins and a host of things you can do with this wonderful tool.

MMC console configurations are saved as MSC files, so one easy way to access your customized console is to save it to the Desktop or any other convenient folder. Then instead of having to load MMC from the command line and load your console file, you can double-click the saved MSC file to bring up both quickly.

One User's Tweak . . .

. . . is another user's dud. Claims of vastly improved performance accompany just about every tweak you pick up on the Internet, but many turn out to be useless exercises. In poring over the countless system adjustments we have seen for XP since it emerged more than a year ago, we settled on a handful that did show demonstrable results on most of the systems we tried. Your own mileage will vary, of course. Here are our favorites. Most of these require a reboot before taking effect.

Use all your memory. WinXP swaps data into virtual memory (aka your hard

drive) even when it doesn't have to, which is why you will get mysterious disk activity in the background even if you have only one app open and a full gig of system RAM. You can force the OS to swap data to disk only when it runs out of volatile memory by adding a line to your System .ini file. Go to the Run dialog box and type **msconfig** to open the System Configuration Utility dialog box. In the System.ini tab, highlight [386enh] and click New to add a new line beneath this branch. Type **ConservativeSwapfileUsage=1** in the empty box that appears, then click Apply and restart your PC. We found that this helped clean up game jerkiness because it

reduces the background file swapping that causes video hiccups and pauses.

Down with dead DLLs. After you shut down a program, Windows tends to hold some of that app's DLLs in memory, which hogs resources and can slow down your PC's loading of the next app. End this behavior with a Registry tweak. (Before starting, you may want to check out all applicable instructions and warnings about proper Registry editing in the previous two Software Tips articles: December *CPU* page 94, January *CPU* page 95). Go to **HKEY_LOCAL_MACHINE\SOFTWARE\MICROSOFT\WINDOWS\CURRENTVERSION\EXPLORER** and create a new subkey named **AlwaysUnload DLL**. This will create a default **DWORD** value, which you should give a value of 1.

Mo' memory, mo' memory, mo' memory. Two **DWORD** values, all at the same Registry key, may goose system performance by keeping more of XP's code in memory at once. Use these values only if you are well stocked with RAM, preferably 512MB (although these tweaks may help systems with 256MB, as well). Go to **HKEY_LOCAL_MACHINE\SYSTEM\CONTROLSET\CONTROL\SESSIONMANAGER\MEMORYMANAGEMENT**. The **DisablePaging Executive** value controls whether XP pages data from memory to the hard drive, and

Café Tweak

Some people seem to have dedicated their lives to squeezing every last drop of performance and customization from Windows, and so there are many invaluable and free tweak repositories online for those who want to test out the latest discoveries or just feed their tweakaholism. Tread carefully, of course, as these sites collect all manner of tips, and sometimes hearsay, from amateurs all over. Here are the ones we bookmark:

Windows XP A to Z (www.windowsexpatoz.com): This searchable database of tips and fixes for XP is incredibly complete and searchable. This is a great starting point for wannabe XP tweakers.

Windows XP Expert Zone (www.microsoft.com/windowsxp/expertzone/default.asp): Love it or hate it, but the fact of the matter is, Microsoft knows its own OS better than anybody. Here you will find a compilation of

weekly and daily tips and the invaluable XP newsgroups of user exchanges.

TweakXP.com (www.tweakxp.com): This is the place for tweakaholics who really need their daily sip. The site posts the latest XP tips, fixes, and adjustments that it finds around the Web. Here you'll also find a newfeed about updates to the OS and new releases of the many third-party Windows utilities. ▲

changing the default value of 0 to 1 turns paging off and may make general operations faster.

Changing the LargeSystemCache value from its default of 0 to 1 tells XP to keep as much of its kernel in memory as possible. Monitor its effect on 256MB systems because it can actually worsen performance by forcing very large applications to swap to disk more often. These two tweaks produced noticeably smoother performance on our testbed with only 256MB.

Excess service. WinXP devotes some background processing time to a number of functions or services that you may not use. Some IT managers have told us that they realize noticeable performance gains

disabling one altogether. Switching a service to manual startup mode is enough to keep it from running automatically but keeps it available for other services to start if necessary.

There are a number of likely services to try switching to manual start mode, but everyone's system is different. The Indexing Service dedicates disk space and resources to tracking files as they open and close. This speeds up hard drive searches but adds overhead to every file access activity. If you can put up with somewhat slower searches, try setting this to manual or disabling it because some other program may try to restart it. There is also the Wireless Zone Configuration service, which you only need if you have an 802.11x adaptor installed.

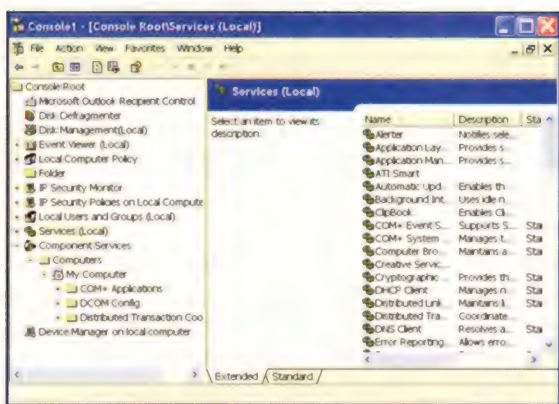
There are many more, but how does an eager tweaker tell the difference between an unnecessary drag on her system and an essential service? Hands down, the best index of WinXP services is maintained by Black Viper at www.blackviper.com/WinXP/servicecfg.htm. The site explains every service in detail and even outlines which other services depend on it. Users contribute experiences with stopping and starting each service and

whether it has an impact on performance. If you are playing with services at all, this is the place to go first.

The long goodbye. The only thing more frustrating than sluggish boot times is pokey shutdowns. What is XP doing on some systems before it finally turns your PC off? It's probably waiting for hung programs and open services to shut down. You can give Windows a quicker goodbye at the HKEY_CURRENT_USER\CONTROL\DESKTOP Registry key. Make sure the HungAppTimeout value is set to 5000 and change the WaitToKillAppTimeout value to 4000. If these entries aren't present, you can create them as new String Values. This will make the OS shut down any open programs faster at logoff.

The biggest shutdown speedup comes from cutting down the time XP waits for services to close. Go to HKEY_LOCAL_MACHINE\SYSTEM\CONTROLSET\CONTROL and be sure the value for WaitToKillServiceTimeout is set to 2000. This, too, is a String Value, so if it is not present, make the new value. **cpu**

by Steve Smith



The services manager lets you monitor, start, and stop the scores of OS services that run in the background at any given moment on most PCs.

by stopping some of this background checking. To see which services are running in your XP, take this shortcut: In the Run dialog box, type `services.msc` to open the Services dialog box. This is one of the snap-ins you can add to the MMC we described earlier.

Highlight any of the services in the Name column to get a brief description of its function in the left margin. The Status column tells you whether the service has started. The Startup Type column shows if the service starts automatically whenever XP starts, if it needs to be started manually or by another service that relies on it or if it is disabled. Right-click any service to open its Properties dialog box, where you can change its Startup setting. Because some services rely on other services, avoid

Infinite Loop Not Good Enough

Ben Edleman wants to reverse-engineer the list of Web sites banned by N2H2's filtering software and is seeking a declaratory judgment from the courts protecting him from legal action. Claiming that Edleman's current research techniques using a database of roughly 500,000 Web sites is a good enough research tool, David Burt, an N2H2 spokesperson, was quoted in the Nov. 1, 2002, issue of the *Harvard Crimson* as saying "His [Edleman's] own research shows that you can do meaningful statistics with large samples, and he found our database 99% accurate."

If Burt's comment was mathematically accurate, than Edleman found roughly 5,000 inaccuracies in his research, or one inaccuracy in every 100 entries. Currently, the search engine AlltheWeb.com has a database of 2.1 billion Web sites. If Edleman's numbers are statistically accurate, than N2H2's filtering software inaccurately blocks some 21 million Web sites listed in AlltheWeb's database. Sometimes 99% just isn't good enough.



WARM UP TO PENGUINS

The Video Issues Linux Users Face, Part II

IN LAST MONTH'S ARTICLE, WE DISCUSSED THE COMPLEX TANGLE OF LEGAL ISSUES THAT ESSENTIALLY PREVENT U.S. LINUX USERS FROM USING THE TV-OUT FEATURE

of video cards. But that doesn't mean you can't use Linux as a PVR (personal video recorder). It just means that your PVR can't be fully featured, at least legally. In this month's article, we'll cover the steps of setting up a legal (in the United States) PVR using Linux.

Where To Begin

There are two major issues to deal with before you can even begin to build your Linux PVR. One is assembling the hardware, and the other is selecting your software. In a way, it's difficult to separate these steps because of driver-support issues and other issues you'll need to deal with. We recommend that you look carefully at the hardware and software issues before you start purchasing your equipment.

In short, selecting your combination of hardware and software involves videophile and audiophile issues and the all-important need for proper drivers. There are two types of multimedia drivers in the Linux world: generic and full-featured. If you're looking to use a Linux box in a PVR capacity, you definitely want full-featured drivers when at all possible, barring legal issues with the DMCA (Digital Millennium Copyright Act).

To begin setting up a PVR in Linux, turn to the V4L (Video 4 Linux) Web site at www.exploits.org/v4l. The site contains a definitive list of supported hardware, pointers to mailing lists and searchable archives, drivers, software, and a link to

the Video for Linux Two project, which is in the process of building a new framework based on many of the issues we touched on in last month's article.

The first thing to do at the V4L site is check out the list of drivers that are currently available. This information, including how fully featured each of the drivers is, will help you narrow down your hardware choices. We also recommend searching the V4L mailing list archives (using the link on the cited page) for posts regarding the specific hardware you decide on before you purchase it.

The hardware components you'll need to build a Linux PVR include:

- A TV tuner card. The tuner lets you select and change cable or antenna channels when used with the appropriate software.
- A video card to display the TV images in a window on your desktop. Any video card you can use under Linux generally will do the job. See your Linux distribution's hardware compatibility database for a list of supported cards.
- A sound card. The feature set should be at least equal to the sound quality your TV tuner card provides, though tuner cards often offer no better than stereo quality (sorry, audiophiles).
- A large, fast hard drive. For high-quality recordings, budget about 3GB per hour, though you can get by with as little as 0.5GB per hour at lower-quality settings. ATA-100 drives at 7,200rpm or better are advisable for better

throughput, especially at higher-quality settings. Consider dedicating an entire drive for this purpose rather than sharing a drive with other file system data. Also, keep in mind that with current release kernels, IDE drives larger than 137GB aren't supported (though a patch has been available for some time), so you may need to apply a patch and build a custom kernel to support drives larger than this.

- An Internet connection of any speed. You'll want to be able to download current program listings in a format your PVR software can use (such as XMLTV), typically once a day or once a week.

The software components you'll need to acquire include:

- Drivers, specifically a driver that lets you tune your TV tuner card to a specific channel as a video-input source.
- An MPEG encoder to capture video input and then encode and optionally compress it into a standard, portable file format.
- A TV listing guide with which to download program listings and see what's playing on what channels, at what times, and for what duration.
- A scheduling system, possibly no more sophisticated than cron, to let you start and stop recordings at specific times with a channel number as a command-line argument.
- An MPEG player for viewing the recordings.
- An interface to unite all of these components to make them easier to use.

Another thing to keep in mind when building a PVR is the noise the hardware will generate. A computer with a hefty power supply fan, noisy hard drive, and several cooling fans will be much noisier than a consumer electronics PVR—

unless you're careful about the hardware you select.

If you don't want the noise coming from your PVR box to distract you while you're watching your recorded programs, keep these tips in mind:

- Don't use a bigger power supply than you need. The more wattage the power supply can handle, the more noise its fans are likely to make. So, for a special-purpose box like this, go small on the power supply. In addition, look for

high pitched, which can drive people with sensitive ears crazy.

- If noise levels are still too high for your liking, consider using special acoustic damping pads on the inside of the chassis. There are also special casings for hard drives that can help if drive noise is still significant.

Build It

Building the PVR itself is largely a matter of configuring software, choosing the right packages for your hardware, and getting any necessary kernel modules built. You will almost certainly want to build a custom kernel for this machine, given you are not likely to use it as a general-purpose workstation.

You will also want the box to have networking capabilities so that you can access TV program listings from the Internet. You may even want to get fancy and set up a small Web serv-

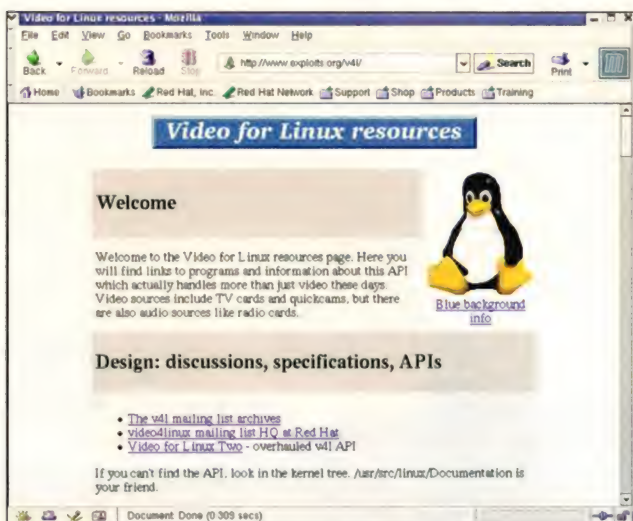
(such as xawtv) and the GATOS project for ATI cards (AVview) include X 11-based graphical interfaces to some of the component functions. The mythTV project (www.mythtv.org) offers a promising look at how a fully integrated Linux PVR might look, along with source code to get you started in that direction.

Take Your Time

Building a PVR can take a little patience, but it's well worth it. Take the time to do your research beforehand because some projects (GATOS included) are still in an experimental stage, and nothing beats reading mailing list archives for a strong lesson on the things to do and things to avoid. Especially in the case of experimental projects, you might notice that most of the development team is using a particular Linux distribution. You can make your life easier by using the same distro.

If you're not familiar with rebuilding kernels or otherwise trimming down your Linux installation, then check out your distribution's Web site and the Linux Documentation Project (www.tldp.org) for assistance. The key is to identify the features you have no earthly use for on the machine and uninstall the software and kernel segments used to support the unnecessary functionality. **CPU**

by Dee-Ann and Robert LeBlanc



Video 4 Linux has a bevy of information available to help set up a PVR in Linux, including hardware, software, driver, and mailing list information.

a quiet or noise-reducing power supply. These will cost you a bit more than ordinary power supplies, but they scale their fan output according to the system load, which means they can run quieter in most circumstances.

- Look for quiet cooling fans and heat-sink designs that do most of the work on their own so that you don't need monstrous fans to keep things cool inside. Fans should have an acoustic rating on the specification sheet, so look for hard numbers. Models using newer fan technologies, such as TMD (tip-magnetic drive), offer a very good cooling-to-noise ratio and are favorites in this type of application.
- Check the spec sheets for the hard drive you intend to use, and look for acoustic data. Some drives are significantly noisier than others, and hard drive noise in particular tends to be

er on the PVR and use PHP scripts to let you view and edit the recording schedule from other machines in your home. You won't want a big, bloated kernel taking up precious RAM, and you'll want to keep as much processor time available for the resource-intensive capture and encoding processes, so you don't want a lot of unnecessary processes running. Think of your PVR as a dedicated, special-purpose device, much like a firewall or router, and alter its Linux installation accordingly.

Integrating the various pieces is where the "art" of putting the PVR together comes in. You can drive many of the applications you'll use from the command line, so they're well suited to shell scripting and cron jobs. On the other hand, if you're looking for an all-in-one graphical interface like you'd find on a consumer appliance, you may have to build it yourself. This said, many of the V4L projects

You & Your Kernel

As most of us know, a kernel is the core piece of software that runs an operating system. You can track the bleeding edge of what's happening in the Linux kernel world through Kernel Traffic and Kernel Cousin (KTKC) at kt.zork.net/kernel-traffic, which is a site that posts weekly summaries of the discussions on the main kernel developers mailing list. This main list has an astounding level of traffic and is of a highly technical nature, so between trying to keep up with the posts and decipher them, the KTKC truly provides a community service. ▲

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KILLER HARDWARE TIPS

A Mouse Of A Different Glow, TV Really Big & Add Storage To Your DVD Player

IF YOU'RE A USER WHO CAN'T LEAVE THINGS ALONE IF THERE'S A CHANCE YOU CAN MAKE THEM BETTER, EVEN IF IT MEANS BUCKING THE NORM, READ ON. WE HAVE SOME TIPS

and tricks that just might make you more productive.

Blue Light Special

What color does your mouse glow? Optical mice typically rely on red LEDs to illuminate the mousing surface. Miguel Fernandez, founder of ExtremeMhz.com, discovered that there's nothing magical about the color red. With some careful soldering, you can replace your mouse's red LED with other colors. Want a blue, green, yellow, or orange glow to emanate from your mouse? No problem. If you prefer no glow at all, you can install an infrared LED.

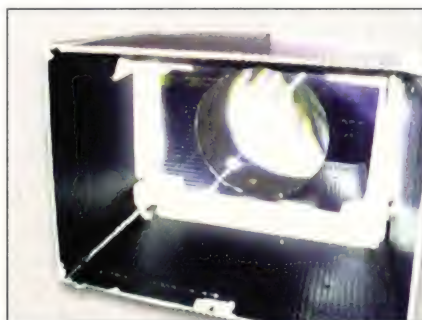
Fernandez wrote a how-to guide for replacing a mouse's LED (www.extrememhz.com/mouseled1.shtml). Also check out www.skybusiness.com/ntanner/Mouse_mod.htm for more on mouse LED replacement.

"I wouldn't say it's tricky, but you will need some basic soldering skills in order to desolder the existing LED and solder back the new one," says Fernandez. "The time it takes to perform this mod may vary depending on the mouse and your soldering skills. I would say about 15 minutes or so."

The LED in an optical mouse provides light for a tiny black-and-white camera to see the mousing surface. Experts say that CMOS sensors have a peak sensitivity around 700nm, which matches the abilities of a red LED. Blue LEDs are at the other end of the color spectrum, at about 400nm.

"A red LED provides the best spectrum of color to accentuate any differences of

the surface for mouse tracking. It really is a finely tuned engine," says Lloyd Klarke, Logitech product manager. "Any changes will affect the performance of the product. If a customer is trying to get the best performance out of a mouse, changing the LED will not do that. If they are looking to experiment or turn their desktop a different color, certainly they can get it to work. I don't doubt that at all."



With some cardboard, tape, and a cheap Fresnel lens, you can turn your itty-bitty TV or computer monitor into an enormous projected image.

"To compensate for the lack of sensor sensitivity, the intensity of light would need to be increased, but light intensity is limited by Class 1 eye safety regulations, the intrinsic capabilities of LEDs, and power consumption through USB," says Klarke.

Fernandez recommends high-intensity LEDs with a rating above 2,400mcd but less than 6,000mcd. (MCD, or millicandela,

refers to the brightness of the LED.) If the LED isn't bright enough, you will lose the ability to accurately control the pointer.

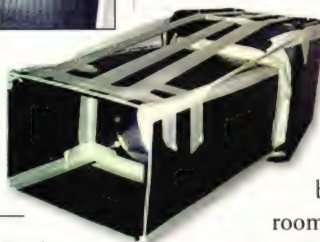
Really Big Screen TV

Any video game player will tell you that a bigger screen is a better screen. Why play on a 12-inch screen when you can play on a 20-incher? And why stick with 20 inches when you can get 50? So then, why limit yourself to a 50-inch so-called "big screen TV" when you can play on a 12-foot, 6-inch screen?

MyImax.com sells a \$21.95 kit that turns any television or computer monitor into a 150-inch image. The kit includes construction plans and a magnifying lens you use to build a projection box out of wood or cardboard. The project takes about an hour, according to the company. When you place the box in front of your TV or monitor, the image is projected on your wall, theater style. Other sites also sell plans-and-lens combos, including Earthprofit.com and A2Z Technology (www.webtv100inch.com). You'll find free plans for building a projection box at www.diiprojectiontv.tk.

You'll need a Fresnel lens (one of those thin, plastic magnifiers often seen on the back of RVs), cardboard, tape, and black paint. You'll also need a bit of patience to navigate this funky site.

After your box is built, you just need a dark room and large blank surface on which to enjoy the abnormally huge image. Because the Fresnel lens inverts the picture, most plans require you to turn the television upside down so the projected image is right side up. Like a movie theater projector, the distance between the projector and screen determines the size of the image. The lens' position within the projection box sets the focus of the image.



LaserMAME (games.lasers.org) is another oversized image hack; it's a modification to the Multiple Arcade Machine Emulator project (www.mame.net) that lets a PC drive a Pangolin QM2000 laser show controller card. The result is that you can play classic vector games, such as *Tempest* and *Asteroids*, by projecting them onto huge surfaces, such as a side of a building or even low clouds.



An IDE cable connects this DVD player to an external drive bay. You can swap out a CompactFlash reader or removable hard drive for moving data between a PC and the DVD player.

Doing this yourself isn't quite as cheap as slapping a lens in front of a raster monitor. According to the LaserMAME Web page, a minimalist, monochrome setup for single-color games like *Asteroids* would cost \$4,000 to \$5,000. Conversely, a professional full-color setup could cost as much as \$30,000.

Add Storage To Your DVD Player

If tricking out your PC hardware ever gets tiresome, retire to the family room and start upgrading your home theater. How about adding storage to your DVD player? A Web site called Area 450 (www.area450.com/thesampozone/articles/connectindex.htm) explains how to hack your DVD player by adding a hard drive, CompactFlash reader, and even an external DVD-ROM drive.

Most of the site's articles focus on mods to Sampo-brand DVD players. Although not a particularly well-known brand, Sampo's players are especially hackable because of their firmware and use of IDE-compatible drive mechanisms.

"The fact that almost all of the Sampo players use an IDE interface for the DVD loader means that you can replace the

stock loader with a conventional PC DVD drive," says Craig Clontz, a founder of Area 450. "Some people have done this as a do-it-yourself repair for players that have gone bad, and some people have swapped their loaders with drives capable of playing higher bit-rate material from CD-R, such as SVCDs and mini DVDs."

Clontz adds, "The presence of an IDE interface was an intriguing factor among hardware hackers from the start because it implied that it might be possible to connect an IDE hard drive to these players." This possibility became reality with Sampo's introduction of the DVE-631CF player, which included a CompactFlash reader and, for the first time, firmware routines to communicate with a slave device on the IDE bus.

"Since a CompactFlash card in an IDE adapter functions just like a solid-state hard disk, the implication was that a hard drive could be placed on the IDE bus instead of the CF adapter. And it worked," Clontz says.

These hardware hacks aren't necessarily limited to Sampo players. Many players from other manufacturers also use IDE interfaces for their DVD loaders and use the same video processor, allowing them to use the DVE-631CF firmware or a modified variant. A community of firmware hackers called the "One Firmware for All" (<http://groups.yahoo.com/group/OneFirmwareForAll>) is active in porting this firmware to other players.

Why would you want to add a hard drive to your DVD player? "Having a hard drive on your player can allow you to create a mega audio/video jukebox," says Clontz. "The DVE-631CF allows the playback of raw JPEG picture files, MP3 audio files, and MPEG movie files using a nice 26-character file name navigation system."

In short, adding a CompactFlash reader to your DVD player would let you display pictures from your digital camera on the television. You could put your entire audio CD collection on a hard drive as MP3 files and have it available for playback on your

DVD player and home theater audio system. The players can't rip information from the internal DVD drive to the hard drive, so you have to copy all the files to the hard drive from a standard PC. Video clips can be in MPEG-1 or MPEG-2. DivX and other AVI formats aren't supported.

The amount of material you can store depends on the hard drive's size, bit rate, and video resolution of the media files. Clontz estimates 1GB per hour of medium-quality MPEG-2 video or 2GB per hour for DVD-quality video.

The Area 450 site includes several projects, including installing a single hard drive, attaching an external drive bay, adding two DVD drives, and adding two hard drives—with no DVD drive installed at all. **cpu**

by Kevin Savetz

Infinite Loop

The Literary Computer

Many well-known authors shun computers for the reassuring clackety-clack of the typewriter or the sensual act of putting a pen to paper. Can you tell which of the following authors have hopped aboard the digital bandwagon and are now writing with computers?

1. Terry Brooks, "The Sword Of Shannara"
2. Tom Clancy, "Sum Of All Fears"
3. Michael Crichton, "Jurassic Park"
4. Don DeLillo, "Underworld"
5. John Irving, "A Prayer For Owen Meany"
6. Stephen King, "From A Buick 8"
7. Joyce Carol Oates, "I'll Take You There"
8. J.K. Rowling, "Harry Potter And The Goblet Of Fire"
9. Salman Rushdie, "The Satanic Verses"
10. Oliver Sacks, "The Man Who Mistook His Wife For A Hat"
11. Kurt Vonnegut, "Slaughterhouse-Five"

Answer: Authors 1, 2, 3, 8, 9, and 11 all use computers (2, 9, and 11 use Macs). Authors 4, 5, 6, 7, and 10 all use a typewriter or write by hand.

Sources: Authors On The Web, Barnes & Noble, BBC News, Doorly.com, January Magazine, MichaelCrichton.net, New York State Writers Institute, Papernews, University of San Francisco, Wired.com.

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Technically Speaking

An Interview With Richard Bartle, Principal Creator Of MUD

Richard Bartle achieved his greatest fame as the principal creator of MUD, the original online text-based Multi-User Dungeon game. Some might argue that without MUD and Bartle's subsequent efforts with MUD2 and other games, today's adventure gaming landscape would be much different. In fact, MUD proved so immensely addictive that it ran from 1985 to 1999 on CompuServe and is still available (free but donations are encouraged) at www.british-legends.com. MUD2 still thrives at www.mud2.com and www.mudii.co.uk.

Although the full tale of MUD (see www.mud.co.uk/muse/backgrnd.htm) is fraught with laughter, bankruptcy, and even suicide, Bartle himself remains an amazingly level-headed and humorous Brit. Born in 1960, Bartle spent most of his youth stuck in a tiny English town with little to do but play games—chief among these was Dungeons & Dragons. When he entered the University of Essex in 1978, Bartle met Roy Trubshaw. Together they would work on what would become MUD.

Even after earning a Ph.D. in artificial intelligence at Essex, Bartle elected to devote his career to MUD2 and games consulting. Few people possess Bartle's history in computer gaming, and of these, none are able to share their experiences and insights with such sizzling wit. True to character, the programmer asked to be interviewed via email because his "BACKSPACE key doesn't work when I talk." ▲



by William Van Winkle

CPU: What are some of the higher-profile projects you've been involved with?

Bartle: I'm not even going to tell you off the record. One of the very high-profile projects I worked on is subject to a major lawsuit at the moment. Had I in the past made any mention of my links to this project to a journalist, I would have been in breach of my NDA [nondisclosure agreement] and would therefore be considered an unreliable witness were I called upon to make a court appearance. Furthermore, if I ignore NDAs, then it means I don't get consultancy work in the future, as people feel they can't trust me. This is why I adhere to them, and why I can't name names.

CPU: What about some past names people might recognize?

Bartle: Well, forces I've consulted for in the U.S. include CompuServe, Interplay, GENie, MPGNet, and Kesmai. If you want me to say I've consulted on high-profile

games like EverQuest, Asheron's Call, Dark Age of Camelot, and Ultima Online, well, I'm not going to.

CPU: Do all of the projects you work with make you sign NDAs?

Bartle: No, of course not. So long as commercial confidentiality isn't involved, I can tell you what I did for CompuServe, MPGnet, eWorld, MPath, et al. It's mainly to do with discussing aspects of game design, community management, and so on, which arose because either they had a license for MUD or MUD2, wanted such a license, or as is the case nowadays, figured that they might be able to benefit from my experience. Most of those companies were what we'd now call "portals," though, which means they a) deigned to allow the people who actually developed games to keep 10% of the money the portal site made off them and b) thought they could develop games themselves despite all evidence to the contrary.

The stuff I've been doing recently is very much still under NDA, as in at least one case it concerns a major product that is still at the design stage. I'm quite happy with that, as it happens—I don't want hundreds of <game> I fans emailing me attempting to influence the design of <game> II.

Massively multiplayer games of the UO, EQ, AC, DAoC variety have yet to celebrate five years of life. They are an ongoing thing. If I were invited to spend a few days at, say, UO Europe's HQ giving their CS system a health check, they wouldn't want the fact made public. Five years from now it might be OK to say so, but now isn't five years from now.

CPU: Given your present work, is MUD your leading resume credential?

Bartle: That and the fact I've worked on it on and off for 20 years. It wasn't all some youthful piece of hacking. I'm big on the theory side of these games. By a huge coincidence, only yesterday I was head-hunted

for a senior post in a computing department at a UK university that is setting up a new section on computer games—too far from where I live, though, sadly. Since then, I've accepted a position of Fellow of Essex University. This is a part-time thing where I deliver a few lectures, in return for which they give me a title. People call me in to discuss their designs because I actually know why things are the way they are in these games, whereas they tend to be comparative newcomers who are only just beginning to realize that they're making some decisions they don't even realize are decisions.

CPU: When you were younger, what did you like to play?

Bartle: I used to play a lot of regular board games, as my father was a keen games player. I also played a lot of games by post and face to face with my friends. My weekend job (pay: £3 a day) was in an amusement arcade, so I got more exposure to arcade games than a lot of people, too. (When I visited the "Game On" computer games exhibition in London in 2002, I managed to get the high score for Galaxian on my first attempt, muahahaha!) I, my brother, and a friend clubbed together and bought one of the first sets of D&D rules to arrive in the UK. The receipt, which I still have, reads "£6.41 1/2 (six pounds, forty-one and a half pence—a lot of money for us). We immediately took to the game and played it to destruction. If you saw the condition now of the box it came in, you'd see what I mean. Ah, those were the days. . . .

CPU: In a nutshell, what was your role in developing the original MUD?

Bartle: I co-wrote it. The original MUD went through three versions. Version 1 was written by Roy Trubshaw to test that his ideas for inter-process communication through writeable shared-memory segments worked. I had nothing to do with that, but given that it was only an evening's work that's not entirely surprising. Version 2 was also written by Roy. This was written in MACRO-10 assembler and would be recognizable as a MUD by people today. Virtually all of this was Roy's, but he was always

willing to listen to ideas from other people (of which I was one). His interests were more to do with programming the game than designing the game world, although he could do both. Version 3 came about because Version 2 was too unwieldy, being written in assembler. Roy wrote it from scratch in BCPL (the forerunner of C), but only got its core finished before he reached the end of his degree and had to leave university to get a job. I took over where he left off. My interests were more to do with designing the game world rather than programming the game, but I could do both. I finished the program, which was about 25% complete when I started on it, and the result was what came to be known as MUD1.

CPU: What computer games do you enjoy playing today and why?

Bartle: I play six sorts of computer games for fun:

- Fantasy role-playing games. I recently finished *Neverwinter Nights*. The engine's OK, but I preferred *Baldur's Gate* because I had more control over the henchmen (and more henchmen).
- Strategy games. I played over 100 games of *Civilization I*, over 125 games of *Civilization II*, and just finished my 18th attempt to win *Civilization III*. It's very good, but not perfect. I don't like the way that it's virtually impossible to get a military victory on a huge map. I had to upgrade my PC to play it, too. 900MHz wasn't fast enough. I just finished winning *Europe Universalis* as the English—yay!—but I prefer turn-based to real-time games. I also prefer games where it doesn't take five years to recover stability after conquering one nondescript Mittel-European city-state.
- Tactical games. I played *Command & Conquer*, I worked my way through all the *AoE* scenarios and had a lot of fun. Not as much fun as I would have had if they'd allowed me to build armies to the size I wanted, but fun all the same. I prefer games with a greater amount of strategy, though.

- Business games. I still dust off *Transport Tycoon* occasionally, but recently I've been playing *Patrician II*, which is excellent, and all the more so because it doesn't cheat, unlike *Patrician I*. It took me five years to beat that.
- Soccer simulations. *Championship Manager* runs on my second PC so I have something to do when something big is downloading or compiling (or *Civ3* is processing computer players' turns). There's something very satisfying in taking a club from the conference league to winning the European Cup.
- Computer versions of board games I like. These are usually terrible disappointments, but I live in hope. The *Diplomacy* one is hopeless. The *Kingmaker* one isn't so bad, and the one for *Advanced Civilization* beats me every single time.

You will note that I only ever play games against the computer, never against other people.

CPU: Why not?

Bartle: Because I hate losing.

CPU: What story and/or design elements make for a truly immortal online game?

Bartle: I'm writing a book that tries to answer this question, so I don't think I can give you a really in-depth answer here. Still, there's only one design element that makes a game immortal: originality. Absolutely no story elements make a game immortal, except those that arise from what players do.

CPU: By the same token, are there design elements that are the kiss of death for games?

Bartle: Any nonemergent story element is the *KoD*. Sorry, AC fans, but your game is living proof. As for design elements, I guess you could say that permanent death is a *KoD* in the current climate. This is a shame, as in design terms it makes for better games. **COU**

To read our entire interview with Richard Bartle, go to
www.cpumag.com/cpufeb03/bartle



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Under Development

A Peek At What's Brewing In The Laboratory

Fresh from the most influential R&D labs around the world, here's a glimpse at some of the technology that scientists, lab techs, and researchers are cooking up for the future.

IBM Gets Domino-like

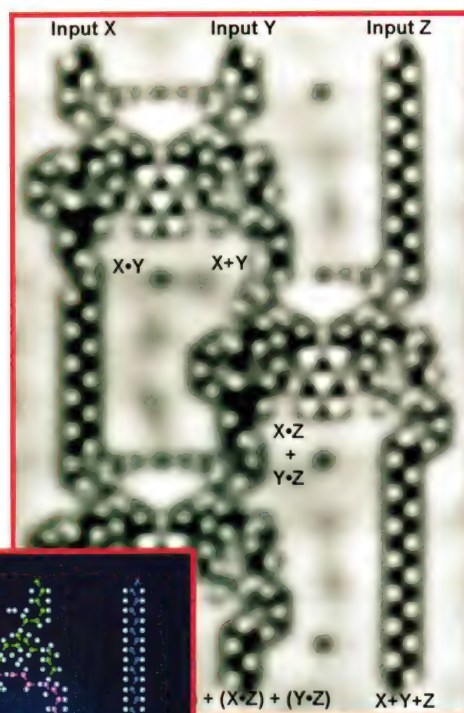
Nanoscience leader IBM recently scored another breakthrough by creating functional logic gates—AND and OR functions, for example—that operate using chains of carbon monoxide molecules. These gates are 260,000 times smaller than conventional silicon-based semiconductor counterparts. The most complex part is a 12- x 17-nanometer three-input sorter that's so small, 190 billion of them could fit atop a pencil eraser.

The mechanism arranges individual and paired CO molecules on a copper substrate to form "sorters" for computing logic. Given the physical constraints of the underlying copper, the paired CO molecules are set to be metastable, meaning they can easily fall into a lower energy configuration. At the top of one sorter pipe, a CO molecule is introduced next to an existing pair, forming an unstable V-shape. Suddenly, the bottom

CO molecule in the V pops out of the group and into the next pair, making that group into another unstable chevron. Out pops another CO and so on, cascading down like dominoes along the constructed paths. The intersections of the sorters determine the value that drops out at the bottom.

Unlike most molecular computing designs, IBM demonstrated the technology equipped with the wiring necessary for linking into a larger computing environment.

Andreas Heinrich, a physicist at IBM's Almaden Research Center, says in a company statement. "The molecule cascade is not only a novel way to do computation, but it is also the first time all of the components



Making AND and OR logic sorters out of CO molecules may help science extend the life of Moore's Law.

necessary for nanoscale computation have been constructed, connected, and then made to com-

pute. It is way smaller than any operating circuits made to date."

IBM's cascading method has its promises and pitfalls. Sorters to date have been made by manually positioning each CO molecule in high-vacuum, near-absolute zero temperature conditions. Much faster construction is needed. Current gate designs are also only good for one use. Conversely, the three-input sorter operates on 100,000 times less energy than an equivalent silicon component. ▲



Sharp Glass Gets Smart

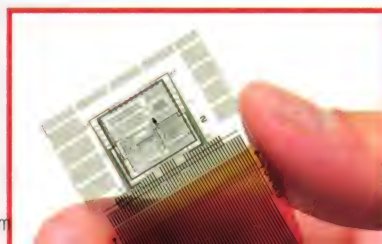
One of the biggest costs inherent to LCD screens is the circuitry behind the glass. Arrays of microchips bonded to the screen act as display cell drivers, which turn pixels on and off. A new technology from Sharp called CG (continuous grain) Silicon allows circuitry to be printed directly onto glass, dispensing with bonded chips and allowing for thinner, higher-resolution displays.

The core of CG involves how efficiently an electrical charge

passes between silicon grains. Areas of grains form regions called domains. The boundaries between domains can be difficult for signals to jump. According to Joel Pollack, vice president of the display business unit for Sharp Microelectronics of the Americas, a signal jumping between CG domains only faces something like a knee-high boundary rather

than a full-height fence. The superior uniformity of grain direction in CG lets electrons travel roughly 600 times faster than in amorphous silicon and about three times faster than in LPS (low-temperature polysilicon), the two mainstream methods used today.

"The advantage over amorphous silicon is that you can make hi-res panels, such as

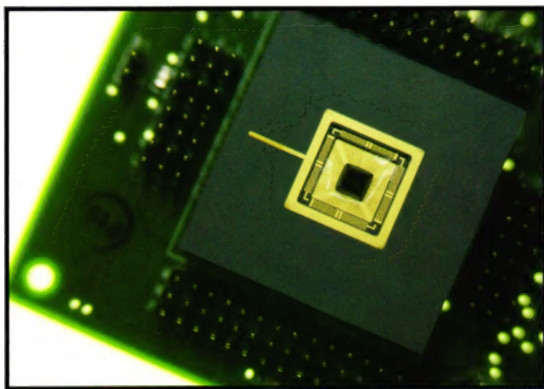


Sharp's new CG Silicon technology lets designers build circuitry directly onto glass substrates. Sharp demonstrated its advance by re-creating a 13,000-transistor Z80 processor onto a glass wafer.

Bell Labs BLAST's Cell Data Rates

So 2.5G cell phone coverage finally arrived in your area, and you snapped up service quicker than Catherine Zeta-Jones can bat an eyelash. Then you found that the advertised 192Kbps data speeds actually perform more like a dusty dial-up modem. Take heart. Bell Labs, the R&D branch of Lucent Technologies, has devised and tested a multiple-antenna chip system called BLAST (Bell Labs Layered Space-Time) that delivers 19.2Mbps speeds—almost four times that of most true 3G cellular networks.

Broadcast technologies have historically struggled with “multipath.” When a signal leaves the broadcast tower, it doesn’t go in a straight line to your antenna. Instead, you receive many ghost images of the signal that have bounced off hillsides, buildings, and more. These images arrive at your antenna at slightly different times and can actually destructively interfere with one another to degrade the signal. The Bell Labs breakthrough involves splitting the primary data stream into multiple substreams and broadcasting each stream over its own transmitter but on the same frequency band. Multiple antennas are used at the receiving end to help treat each scattered stream as a separate, parallel subchannel. This MIMO (multiple input/multiple output) design essentially



BLAST chips, developed by Bell Labs, may soon radically increase the capacity and speed of wireless networks while consuming less battery power in handsets and notebooks.

runs four 3G connections in tandem, delivering the aggregate bandwidth of all the streams.

“There has been a scramble around the world to put MIMO in silicon,” says Ran Yan, Bell Labs’ vice president of wireless research, in a statement. “We believe ours are the world’s first chips that can be used in handsets with four antennas, and therefore the first capable of such high transmission speeds. Not

only have we proven the commercial feasibility of BLAST, but we’ve also verified the performance figures our researchers predicted when they first theorized that it might be possible to exploit interference to achieve faster and more efficient communications.”

BLAST presently involves using two chips. One detects BLAST signals; the other decodes them. The chips are so low-power, they can easily work in contemporary cell phone designs and will also likely find homes in tomorrow’s wireless-enabled notebooks. ▲

VGA in a 3.7-inch panel,” says Pollack. “Before you couldn’t get enough pixel density to drive an LCD in such a small diagonal. It also lets you build system electronics inside the display at the same time that you’re building the display, so you can put more in a smaller space and avoid putting those components on the motherboard.

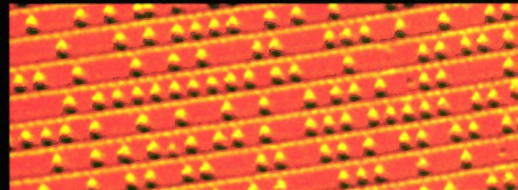
With less weight and size and other CG attributes, don’t be surprised to someday see “game panes,” small display panels with controls, memory, processing, and even short-range wireless networking built into the glass. Sharp has already announced plans for CG-enabled PDAs and smart phones, and OEM developers will be announced soon. The biggest benefit for consumers will be CG’s superior resolution.

“With CG, you could make XGA, UXGA—the density limit of what the human eye can see,” says Pollack. “Normally, an extraordinary display is considered to be 200ppi, but to get to that point in a mobile display, you need CG Silicon.” ▲

Pushing Around Atomic Bits

Although most scientists and standards bodies are puzzling over how to make smaller optical disc divots or magnetic particles for disk platters, physics professor Franz Himpfel of the University of Wisconsin-Madison is working with storage bits almost unimaginably dense: individual atoms. Himpfel uses silicon atoms loosely bonded to a silicon substrate. The substrate is grooved into tracks to help organize the bits, each of which a STM (scanning tunneling microscope) can add or remove. As the STM makes a reading pass along a track, the presence or absence of an extra silicon atom can be interpreted as a 1 or 0 binary value.

“The density is 250 terabits per square inch,” says Himpfel, “which is about a million times denser than a CD-ROM. DNA uses about the same number of atoms per bit as our memory and has a comparable readout speed.”



These silicon atoms lined up in tracks on a silicon substrate actually function as digital memory bits.

Speed is one critical limiter. As data density rises, data read/write speeds drop. This is partly due to smaller bits involve smaller energy levels, which increases the amount of noise inherent in the data’s transfer stream. Getting an acceptably accurate signal means more time confirming the state of each bit. Moreover, although STMs can read Himpfel’s memory at room temperature, reliable writing requires liquid helium to cool the medium.

Himpfel says faster approaches are needed; he favors moving to electrons. He says it may be years before atomic memory becomes practicable.

“If I extrapolate Moore’s law of the exponential shrinkage of silicon devices,” he says, “it will take about 30 years to get down to the dimensions of our memory. . . .” ▲

Back Door

Q&A With Shari Steele

As the executive director and president of the Electronic Frontier Foundation, Shari Steele's name is well suited to her job. The EFF fights some of the country's toughest legal battles against opponents such as the recording industry and the U.S. Secret Service.

Q In a nutshell, what does the EFF do?

STEELE: Our biggest thing is trying to defend civil liberties when there are new technologies involved. We're trying to make sure that civil liberties are thought about and protected because a lot of times changes in technology have an effect on freedom of speech or privacy that people don't necessarily think about.

Q What are the most dangerous pieces of legislation currently under consideration?

STEELE: The Berman Bill, which is this peer-to-peer bill that would basically allow copyright holders to send viruses and do all sorts of damage to your computer if you're engaging in peer-to-peer file sharing and engaging in copyright infringement. They'll be able to create files that look like they're music files, MP3 files, that people will download. Furthermore, these companies will have no liability if they cause damage to your machine. That's a pretty scary one.

Another one is the CBDTPA, the Consumer Broadband and Digital Television Promotion Act. That one's really scary because it would basically let the entertainment industry decide what kinds of technologies get to get rolled out and which ones don't. It will allow them to say that anything that doesn't read the digital rights management systems that we're putting on our movies can't be used. You, manufacturers, need to create products that are going to follow the limitations that we're putting on our



products, and if you create products or innovations that don't keep these limitations in place, then you're going to be in violation of the law.

Q Do you think the entertainment industry figures that the average person is simply not technically educated enough to be able to understand these issues and want to stick up for them when it comes to voting time?

STEELE: I think that's probably true. Most people aren't really paying attention to the battles that are going on right now, and they will lose their rights before they even know that anything has happened. There's a huge discussion taking place right now on HDTV, the new digital television, that's going to be the only thing transmitted a few years from now. You wouldn't be able to receive the broadcast unless you have licensed players. The issue is whether or not technology companies need to really be limited by the entertainment industry's requirements. Right now, it's being done in standards committees rather than by Congress. But the CBDTPA would make it so that Congress is actually getting involved in making it illegal for technology companies to create innovative designs that haven't been preapproved by the entertainment industry. And consumers have no idea that they're not going to

be able even to receive digital signals. They are not going to be able to receive broadcast television.

Q Have some of our digital rights already been curtailed?

STEELE: Rights have changed, and that's a good thing. The amount of speech that you can get access to now is incredible. The ability of you as an individual to get your word out to lots of people has increased tremendously. But it's much easier now for companies you shop with to track you, to know not only what you purchase but even which Web pages you look at to know what you've even been doing. The antiterrorism legislation has made it so that the FBI can track your Web browsing habits, and they probably are doing it already if you've indicated at all that you've got any interest in what's going on with the Palestinian terror groups. Or take al-Qaeda, for example. If you go to al-Qaeda's Web site, just because you're interested in knowing about al-Qaeda, I think it's pretty safe to say that your Web browsing habits will be tracked from now on.

Q What's the most important thing someone should understand about your "message?"

STEELE: That there are civil liberties issues involved with technology. That's the biggest thing that people don't seem to really get. And that we should really be careful if something is necessary before we start giving away our rights.

For our full interview, see www.cpumag.com/cpufeb03/steele.

William Van Winkle began writing for computer magazines in 1996. He was first published in 1990, the same year he took his first job in computers. He and his family live outside of Portland, Ore.



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